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NOTICE INVITING TENDER

(Document No PS:MSX:NIT)

Bharat Heavy Electricals Limited

Ref*: BHEL/NR/SCT/ D R CONGO/HTG/1033*

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NOTICE INVITING E-TENDER (NIT)
BIDDER TO SUBMIT OFFERS ON PORTAL
https://bheleps.buyjunction.in

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To

Dear Sir/Madam

Sub : NOTICE INVITING E-TENDER

Sealed offers in two part bid system are invited from reputed & experienced bidders (meeting PRE QUALIFICATION CRITERIA as mentioned in Annexure-I) for the subject job by the undersigned on the behalf of BHARAT HEAVY ELECTRICALS LIMITED as per the tender document. Following points relevant to the tender may please be noted and complied with.

1.0 **Salient Features of NIT**

S. NO.	ISSUE	DESCRIPTION	
i	TENDER NUMBER	BHEL / NR / SCT / D R CONGO / HTG / 1033	
ii	Broad Scope of job	Material handling, Erection, Testing, Commissioning, Trial operations & handing over of E&M packages including Kaplan turbines, Generators and its auxiliaries, Excitation Systems, Generator Transformers, C&I, EOT Crane, Fire Fighting System, VAC system etc. and providing other miscellaneous services for 4x16 MW Grand Katende Hydro Power Project, D R Congo.	
iii	DETAILS OF TENDER DOCUMENT		
a	Volume-IA	*Technical Conditions of Contract (TCC) consisting of Scope of work, Technical Specification, Drawings, Procedures, Bill of Quantities, Terms of payment, etc*	*Applicable*
b	Volume-IB	*Special Conditions of Contract (SCC)*	*Applicable*
c	Volume-IC	*General Conditions of Contract (GCC)*	*Applicable*
d	Volume-ID	*Forms and Procedures*	*Applicable*
e	Volume-II	*Price Schedule (Absolute value).*	*Applicable*
iv	Issue of Tender Documents	From BHEL website (www.bhel.com) and https://bheleps.buyjunction.in Tender documents will be available at website till due date of submission	*Applicable*
v	DUE DATE & TIME OF OFFER SUBMISSION	***Date : 11/08/2016 , Time : 1500 HRS*** ***Place : on https://bheleps.buyjunction.in***	*Applicable*
vi	OPENING OF TENDER	***At due date / time*** ***Date : 11/08/2016, Time: 1530 HRS*** *(Notes: (1) In case the due date of opening of tender becomes a non-working day, then the due date & time of offer submission and opening of tenders get extended to the next working day.*	*Applicable*

		(2) Bidder may depute representative to witness the opening of tender. ***However it being an e-tender it shall be opened on online***	
vii	**EMD AMOUNT**	*Rs. 2,00,000/- or USD 2940/-*	*Applicable*
viii	**COST OF TENDER**	*NIL*	*Not Applicable*
ix	**LAST DATE FOR SEEKING CLARIFICATION**	***Five days before bid submission due date.*** *Along with soft version also, addressing to undersigned*	*Applicable*
x	**SCHEDULE OF Pre Bid Discussion (PBD)**		*Not applicable*
xi	**INTEGRITY PACT & DETAILS OF INDEPENDENT EXTERNAL MONITOR (IEM)**	*Shri D.R.S Chaudhary, IAS (Retd.)* *E-1/164 Arera Colony* *Bhopal 462016* *Email: dilip.chaudhary@icloud.com*	*Applicable*
xii	**Latest updates**	Latest updates on the important dates, Amendments, Correspondences, Corrigenda, Clarifications, Changes, Errata, Modifications, Revisions, etc to Tender Specifications will be hosted in BHEL webpage (www.bhel.com -->Tender Notifications →View Corrigendums) & portal https://bheleps.buyjunction.in **and not in the newspapers**. Bidders to keep themselves updated with all such information	
xiii	**Tender submission**	on portal https://bheleps.buyjunction.in	

2.0 The offer shall be submitted as per the instructions of tender document and as detailed in this NIT. Bidders to note specifically that all pages of tender document, including these NIT pages of this particular tender together with subsequent correspondences shall be submitted by them. **Rates/Price including discounts/rebates, if any, mentioned anywhere/in any form in the techno-commercial offer other than the Price Bid, shall not be entertained.**

3.0 Not used.

4.0 Unless specifically stated otherwise, bidder shall deposit EMD through Demand Draft/Pay Order in favour of Bharat Heavy Electricals Ltd, payable at Noida. As this tender is an E-Tender and no paper bids will be accepted therefore the scanned copy of the Demand Draft/ Pay Order should be uploaded in the E procurement portal. Hard Copy of the Demand Draft/ Pay Order should reach BHEL PSNR HQ Noida before the due date and time of bid submission. BHEL shall not be responsible for postal or any other delays in this regard. For other details and for 'One Time EMD' please refer General Conditions of Contract.

5.0 **Procedure for Submission of Tenders**: This is an E-tender floated online through our E-Procurement Site **https://bheleps.buyjunction.in.** The bidder should respond by submitting their offer online only in our e-Procurement platform at https://bheleps.buyjunction.in. Offers are invited in two-parts only.

Documents Comprising the e-Tender

The tender shall be submitted online ONLY EXCEPT TENDER FEE & EMD (in physical form) as mentioned below:

a. Technical Tender (UN priced Tender)

All Technical details (eg. Eligibility Criteria requested (as mentioned below)) should be attached in e-tendering module, failing which the tender stands invalid & may be REJECTED. Bidders shall furnish the following information along with technical tender (preferably in pdf format):

i. Tender Cost and Earnest money Deposit (EMD) furnished in accordance with NIT Clause 3.0 & 4.0. Alternatively, documentary evidence for claiming exemption as per clause 29 of NIT

ii. Technical Bid (without indicating any prices).

b. Price Bid:

i. Prices are to be quoted in the attached Price Bid format online on e-tender portal.
ii. The price should be quoted for the accounting unit indicated in the e-tender document.
iii. Note: It is the responsibility of tenderer to go through the Tender document to ensure furnishing all required documents in addition to above, if any. Any deviation would result in REJECTION of tender and would not be considered at a later stage at any cost by BHEL.
iv. A person signing (manually or digitally) the tender form or any documents forming part of the contract on behalf of another shall be deemed to warrantee that he has authority to bind such other persons and if, on enquiry, it appears that the persons so signing had no authority to do so, the purchaser may, without prejudice to other civil and criminal remedies, cancel the contract and hold the signatory liable for all cost and damages.
v. A tender, which does not fulfil any of the above requirements and/or gives evasive information/reply against any such requirement, shall be liable to be ignored and rejected.
vi. In case offer is sent through hard copy/fax/telex/cable/electronically in place of e-tender, same shall not be considered.

DO NOT"S

Bidders are requested NOT to submit the hard copy of the Bid. In case offer is sent through hard copy/fax/telex/cable/electronically in place of e-tender, the same shall not be considered. **Also, uploading of the price bid in prequalification bid or technical bid may RESULT IN REJECTION of the tender**.

Digital Signing of e-Tender

Tenders shall be uploaded with all relevant PDF/zip format. The relevant tender documents should be uploaded by an authorized person having Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION digital signature certificate (DSC).

The Requirement:

1. A PC with Internet connectivity &
2. DSC (Digital Signature Certificate)(**Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION**)

BHEL has finalized the e-procurement service Provider-:

M/s M Junction services Limited, Kolkata

Godrej Water Side, 3rd Floor, Tower-1, Plot-V, Block - DP
Sector - V, Salt Lake, Kolkata-700091, West Bengal, INDIA

The contact details of the service provider are given below:

1. M/s MJUNCTION SERVICES LTD., Kolkata:
   Mr. Vipan Singh (Mob: 9717149600), Mr. Ashish Bharadwaj (Mob: 97171 32381)
   Mr. Samya Mukherjee (Mob: 91633 48220), Mr. Sumant Chowdhury (Mob: 91633 48104)

2. Customer care Help Desk of M/s MJUNCTION SERVICES LIMITED, Kolkata:
   Tel ~ 033 - 66011717 (From 9.30 am to 5.30 pm),
   Mob - 91633 48283 - 86/ 85840 08116 (From 5.30 pm to 8.30 pm)
   HELPDESK email: eps.customercare@mjunction.in,
   The process of utilizing e-procurement necessitates usage of **DSC (Digital Signature Certificate)(Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION)** and you are requested to procure the same immediately, if not presently available with you. Please note that only with DSC, you will be able to login the e-procurement secured site and take part in the tendering process.

3. The contact details of the DSC Certifying Authority as given below

1	**GNFC**	www.ncodesolutions.com
2	**e-Mudhra**	http://www.e-Mudhra.com
3	**Safescrypt**	www.safescrypt.com

Vendors are also requested to go through seller manual available on www.bheleps.buyjunction.in

6.0 **Not Used**

7.0 Deviation with respect to tender clauses and additional clauses/ suggestions in Techno-commercial bid / Price bid shall NOT be considered by BHEL. Bidders are requested to positively comply with the same.

8.0 BHEL reserves the right to accept or reject any or all Offers without assigning any reasons thereof. BHEL also reserves the right to cancel the Tender wholly or partly without assigning any reason thereof. Also BHEL shall not entertain any correspondence from bidders in this matter (except for the refund of EMD).

9.0 **Assessment of Capacity of Bidders:**

Bidders capacity for executing the job under tender shall be assessed 'LOAD' wise and 'PERFORMANCE' wise as per the following:

I. **LOAD**: Load takes into consideration **ALL** the contracts of the Bidder under execution with BHEL Regions, irrespective of whether they are similar to the tendered scope or not. The 'Load' is the sum of the unit wise identified packages (refer Table-1) for contracts with BHEL Regions. The cut off month for reckoning 'Load' shall be the month, two (2) months preceding the month corresponding to the 'latest date of bid submission', in the following manner:

(Note: For example if latest bid submission is in Aug 2011, then the 'load' shall be calculated upto and inclusive of June 2011)

i). Total number of Packages

Total number of Packages in hand = P

Where

- 'P' is the sum of all unit wise identified packages under execution with BHEL Regions as of the cut off month defined above, including packages yet to be commenced, excepting packages which are on HOLD due to reasons not attributable to Bidder..

II. **PERFORMANCE**: Here 'Monthly Performance' of the bidder for all the packages (**under execution**/ executed during the 'Period of Assessment' in all the Power Sector Regions of BHEL) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced shall be taken into consideration. The 'Period of Assessment' shall be 6 months preceding the cut off month. The cut off month for reckoning 'Period of Assessment' shall be the month two (2) months preceding the month corresponding to the 'latest date of bid submission', in the following manner:

(Note: For example if 'latest date of bid submission' is in Aug 2011, then the 'performance' shall be assessed for a 6 month period upto and inclusive of June 2011, for all the unit wise identified packages (refer Table I)

i). Calculation of Overall 'Performance Rating' for 'similar Package/Packages' for the tendered scope under execution at Power Sector Regions for the 'Period of Assessment':

This shall be obtained by summing up the 'Monthly Performance Evaluation' scores obtained by the bidder in all Regions for all the similar Package/packages', divided by the total number of Package months for which evaluation should have been done, as per procedure below:

a) $P_1, P_2, P_3, P_4, P_5, \ldots P_N$ etc be the packages (**under execution**/ executed during the 'Period of Assessment' in all Regions) **SIMILAR** to the packages covered under the tendered scope, excepting packages not commenced. Total number of similar packages for all Regions = $\mathbf{P_T}$ (ie $P_T = P_1 + P_2 + P_3 + P_4 + .. P_N$)

b) Number of Months 'T_1' for which 'Monthly Performance Evaluation' as per relevant formats, should have been done in the 'Period of Assessment' for the corresponding similar package P_1. Similarly T_2 for package P_2, T_3 for package P_3, etc for the tendered scope. Now calculate cumulative total months '$\mathbf{T_T}$' for total similar Packages '$\mathbf{P_T}$' for all Regions (i.e $\mathbf{T_T} = T_1 + T_2 + T_3 + T_4 + .. T_N$)

c) Sum 'S_1 ' of 'Monthly Performance Evaluation' Scores (S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, S_{1-5},…. S_{1-N}) for similar package P_1, for the 'period of assessment' 'T_1' (i.e $S_1 = S_{1-1}+ S_{1-2}+ S_{1-3}+ S_{1-4}+ S_{1-5}+…S_{1-N}$). Similarly S_2 for package P_2 for period T_2, S_3 for package P_3 for period T_3, etc for the tendered scope for all Regions. Now calculate cumulative sum 'S_T' of 'Monthly Performance Evaluation' Scores for total similar Packages 'P_T' for all Regions (i.e 'S_T '$= S_1+ S_2+ S_3+ S_4+ S_5+…. S_N$.)

d) **Overall Performance Rating 'R_{BEHL}' for the similar Package/Packages** (**under execution**/ executed during the 'Period of Assessment') in all the Power Sector Regions of BHEL)**:**

$$= \frac{\text{Aggregate of Performance scores for all similar packages in all the Regions}}{\text{Aggregate of months for each of the similar package for which performance should have been evaluated in all the Regions}}$$

$$= \frac{S_T}{T_T}$$

e) Bidders to note that the risk of non evaluation or non availability of the 'Monthly Performance Evaluation' reports as per relevant formats is to be borne by the Bidder

f) Table showing methodology for calculating 'a', 'b' and 'c' above

Sl no	Item Description	Details for all Regions							Total
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
1	Similar Packages for all Regions → (under execution/ executed during period of assessment)	P_1	P_2	P_3	P_4	P_5	…	P_N	Total No of similar packages for all Regions = **P_T** ie Sum (Σ) of columns (iii) to (ix)
2	Number of Months for which 'Monthly Performance Evaluation' as per relevant formats should have been done in the 'period of assessment for corresponding similar Package (as in row 1)	T_1	T_2	T_3	T_4	T_5	…	T_N	Sum (Σ) of columns (iii) to (ix) = **T_T**
3	Monthly performance scores for the corresponding period (as in Row 2)	S_{1-1}, S_{1-2}, S_{1-3}, S_{1-4}, … S_{1-T1}	S_{2-1}, S_{2-2}, S_{2-3}, S_{2-4}, … S_{2-T2}	S_{3-1}, S_{3-2}, S_{3-3}, S_{3-4}, … S_{3-T3}	S_{4-1}, S_{4-2}, S_{4-3}, S_{4-4}, … S_{4-T4}	S_{5-1}, S_{5-2}, S_{5-3}, S_{5-4}, … S_{5-T5}	.. … … … …	S_{N-1}, S_{N-2}, S_{N-3}, S_{N-4}, … S_{N-TN}	---------
4	Sum of Monthly Performance scores of the corresponding Package for the corresponding period (as in row-3)	S_1	S_2	S_3	S_4	S_5	…	S_N	Sum (Σ) of columns (iii) to (ix) = **S_T**

ii) Calculation of Overall 'Performance Rating' (**R_{BHEL}**) in case 'similar Package/Packages' for the tendered scope ARE NOT AVAILABLE, during the 'Period of Assessment':

This shall be obtained by summing up the 'Monthly Performance Evaluation' scores obtained by the bidder in all Regions for ALL the packages, divided by the total number of Package months for which

evaluation should have been done. 'R_{BHEL} ' shall be calculated subject to availability of 'performance scores' for at least.6 'package months' in the order of precedence below:

a) 'Period of Assessment.
b) 12 months preceding the cut-off month
c) 24 months preceding the cut-off month
d) 36 months preceding the cut-off month

In case, R_{BHEL} cannot be calculated as above, then Bidder shall be treated as 'NEW VENDOR'. Further eligibility and qualification of this bidder shall be as per definition of 'NEW VENDOR' described in 'Explanatory Notes'.

iii) Factor "L" assigned based on Overall Performance Rating (R_{BHEL}) at Power Sector Regions,:

Sl no	Overall Performance Rating (R_{BHEL})	Corresponding value of 'L'
1	=60	NA
2	> 60 and ≤ 65	0.4
3	> 65 and ≤ 70	0.35
4	> 70 and ≤ 75	0.25
5	> 75 and < 80	0.2
6	≥ 80	NA

III. 'Assessment of Capacity of Bidder':

'Assessment of Capacity of Bidder' is based on the Maximum number of packages for which a vendor is eligible, considering the performance scores of similar packages, as below:

Max number of packages P_{Max}= (R_{BHEL}- 60) divided by corresponding value of 'L'
i.e. (R_{BHEL}- 60)/L

Note:

i. In case the value of P_{Max} results in a fraction, the value of P_{Max} is to be rounded off to next whole number
ii. For R_{BHEL} = 60 , P_{Max} = '1'
iii. For R_{BHEL} ≥ 80, there will be no upper limit on P_{Max}

The Bidder shall be considered 'Qualified' as per 'Assessment of Capacity of Bidder' for the subject Tender if $P \leq P_{Max}$
(where P is calculated as per clause 9.I)

IV. **Explanatory note**:

a) Similar package means Boiler or ESP or Piping or Turbine or Civil or Structure or Electrical or CI, etc at the individual level irrespective of rating of Plant, and irrespective of whether the subject tender is a single package or as part of combined/composite packages. Normally Boiler, ESP, Piping, Turbine, Electrical, CI, Civil, Structure, etc is considered individual level of package. For example in case the tendered scope is a Boiler Vertical Package comprising of Boiler, ESP and Power Cycle Piping (i.e the 'identified packages as per Table-1 below), the 'PERFORMANCE' part against sl no II above, needs to be evaluated considering all the identified packages (ie Boiler, ESP and Power Cycle Piping) and finally the Bidder's capacity to execute the tendered scope is assessed in line with III above.

b) Identified Packages (Unit wise)

Table-1

	Civil	Electrical & CI	Mechanical
	i). Enabling works ii). Pile and Pile Caps iii). Civil Works including foundations iv). Structural Steel Fabrication & Erection v). Chimney vi). Cooling Tower vii). Others (Civil)	i). Electrical ii). CI iii). Others (Elec & CI)	i). Boiler & Aux (All types including CW Piping if applicable) ii). Power Cycle Piping/Critical Piping iii). LP Piping iv). ESP v). Steam Turbine Generator set & Aux vi). Gas Turbine Generator set & Aux vii). Hydro Turbine Generator set & Aux viii). Turbo Blower (including Steam Turbine) ix). Material Handling x). Material Management xi). Material Handling & Material Management xii). Others (Mechanical)

c) Bidders who have not been evaluated for at least six package months in the last 36 months in the online BHEL system for contractor performance evaluation in BHEL PS Regions, wef July'2010 shall be considered "NEW VENDOR".

A 'NEW VENDOR' shall be considered qualified subject to satisfying all other tender conditions

A 'NEW VENDOR' if awarded a job (of package/packages identified under this clause) shall be tagged as "FIRST TIMER" on the date of first LOI/ LOA from BHEL.

The "FIRST TIMER" tag shall remain till execution of work for a period of not less than 09 months, from the commencement of work of first package

A Bidder shall not be eligible for the next job as long as the Bidder is tagged as "FIRST TIMER" excepting for the Tenders which have been opened on or before the date of the bidder being tagged as 'FIRST TIMER'.

After removal of 'FIRST TIMER' tag, the Bidder shall be considered 'QUALIFIED' for the future tenders subject to satisfying all other tender conditions including 'Capacity Evaluation of Bidders'.

In case assessment of 'FIRST TIMER' cannot be done for 9 months due to **completion of work in less than 9 months**, the 'FIRST TIMER' tag will be removed and the vendor shall be considered as 'NEW VENDOR' for any new tender/s, provided the average score for which Performance Evaluation has been done, is not less than 60%.

d) In the unlikely event of all bidders shortlisted against Technical and Financial Qualification criteria not meeting the criteria on 'Assessment of Capacity of Bidders' detailed above, OR leads to a single tender response on applying the criteria of 'Assessment of Capacity of Bidders' or due to non-approval by Customer, then BHEL at its discretion reserves the right to consider the further processing of the Tender based on the **Overall Performance Rating** 'R_{BHEL}**'** only, starting from the upper band.

e) 'Under execution' shall mean works in progress as per the following:

i. up to Boiler Steam Blowing in case of Steam Generator and Auxiliaries

ii. upto Synchronisation in case of all other works excepting sl no (i) and (iii)

iii. Upto execution of at least 90% of anticipated contract value in case of Civil & Structures (unit wise), Enabling works and upto 90% of material unloading (in tonnage) as per the original contract in case of MM Package.

Note : BHEL at its discretion can extend (or reduce in exceptional cases in line with Contract conditions) the period defined against (i), (ii) and (iii) above, depending upon the balance scope of work to be completed.

f) Performance evaluation in CL 9 above is applicable to Prime bidder and consortium partner (or Technical tie up partner) for their respective scope of work.

10.0 Since the job shall be executed at site**,** bidders may visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc before quoting for this tender. They may also consult this office before submitting their offers, for any clarifications regarding scope of work, facilities available at sites or on terms and conditions.

11.0 For any clarification on the tender document, the bidder may seek the same over e-procurement portal, as per specified format, within the scheduled date for seeking clarification, from the office of the undersigned. BHEL shall not be responsible for receipt of queries after due date of seeking clarification due to postal delay or any other delays. Any clarification / query received after last date for seeking clarification may not be normally entertained by BHEL and no time extension will be given.

12.0 BHEL may decide holding of pre-bid discussion [PBD] with all intending bidders as per date indicated in the NIT. The bidder shall ensure participation for the same at the appointed time, date and place as may be decided by BHEL. Bidders shall plan their visit accordingly. The outcome of pre-bid discussion (PBD) shall also form part of tender.

13.0 In the event of any conflict between requirement of any clause of this specification/ documents/drawings/data sheets etc or requirements of different codes/standards specified, the same to be brought to the knowledge of BHEL in writing for clarification before due date of seeking clarification (whichever is applicable), otherwise, interpretation by BHEL shall prevail. Any typing error/missing pages/ other clerical errors in the tender documents, noticed must be pointed out before pre-bid meeting/submission of offer, else BHEL's interpretation shall prevail.

14.0 Unless specifically mentioned otherwise, bidder's quoted price shall deemed to be in compliance with tender including PBD.

15.0 Bidders shall submit Integrity Pact Agreement (Duly signed by authorized signatory who signs in the offer), **if applicable**, along with techno-commercial bid. This pact shall be considered as a preliminary qualification for further participation. **The names and other details of Independent External Monitor (IEM) for the subject tender is as given at point 1(xi) above.**

15a. **Integrity Pact (IP)**

1. IP is a tool to ensure that activities and transactions between the Company and its Bidders / Contractors are handled in a fair, transparent and corruption free manner. A panel of Independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL.

   The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory who signs in the offer) along with techno-commercial bid. Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

   Details of IEM for this tender is given at point 1(xi) above.

2. Please refer Section-8 of the IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender.

   No routine correspondence shall be addressed to the IEM (phone / post / email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification / issues shall be addressed directly to the tender issuing (procurement) department.

16.0 The Bidder has to satisfy the Pre Qualifying Requirements stipulated for this Tender in order to be qualified. The Price Bids of only those bidders will be opened who will be qualified for the subject job on the basis of satisfying the Pre Qualification Criteria specified in this NIT as per Annexure-I (as applicable), past performance etc. and date of opening of price bids shall be intimated to only such bidders. BHEL reserves the right not to consider offers of parties under HOLD.

17.0 Not used.

18.0 An email intimation regarding e - price bid opening shall be sent to all techno-commercially qualified parties. Validity of the offer shall be for **six months** from the latest due date of offer submission (including extension, if any) unless specified otherwise.

19.0 BHEL reserves the right to decide the successful bidder on the basis of Reverse Auction process. In such case all qualified bidders will be intimated regarding procedure/ modality for Reverse Auction process prior to Reverse Auction and price will be decided as per the rules for Reverse Auction.

However, if reverse auction process is unsuccessful as defined in the RA rules/procedures, or for whatsoever reason, then the sealed 'PRICE BIDs' will be opened for deciding the successful bidder. BHEL's decision in this regard will be final and binding on bidder.

20.0 On submission of offer, further consideration will be subject to compliance to tender & qualifying requirement and customer's acceptance, as applicable.

21.0 In case the bidder is an "Indian Agent of Foreign Principals", 'Agency agreement has to be submitted along with Bid, detailing the role of the agent along with the terms of payment for agency commission in INR, along with supporting documents.

22.0 The bidders shall not enter into any undisclosed M.O.U. or any understanding amongst themselves with respect to tender.

23.0 Consortium Criteria shall be as specified in Pre-Qualifying Requirement (PQR) at Annexure- I of NIT

24.0 The bidder shall upload documents in support of possession of 'Qualifying Requirements' duly self-certified and stamped by the authorized signatory, indexed and properly linked in the format for PQR. In case BHEL requires any other documents/proofs, these shall be submitted immediately.

25.0 The bidder may have to produce original document for verification if so decided by BHEL.

26.0 The offers of the bidders who are on the banned/ hold list as also the offer of the bidders, who engage the services of the banned/ hold firms, shall be rejected. The list of **banned/ hold firms** is available on BHEL web site www.bhel.com.

27.0 BHEL reserves the right to go for **Reverse Auction (RA**) instead of opening the price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit "online sealed bid" in the Reverse

Auction. Non-submission of "online sealed bid" by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue."

Information and General Terms and Conditions governing RA shall form part of the RFQ/ Enquiry.

28.0 It may please be noted that **guidelines/rules** in respect of Suspension of Business dealings', 'Vendor evaluation format', 'Quality, Safety & HSE guidelines', milestone/completion certificate, etc may **undergo change** from time to time and the latest one shall be followed. The abridge version of extant 'Guidelines for suspension of business dealings with suppliers/ contractors' is available on www.bhel.com on "**supplier registration page".**

29.0 **Micro and Small Enterprises (MSE)**

Any Bidder falling under MSE category, shall furnish the following details & submit documentary evidence/ Govt. Certificate etc. in support of the same along with their techno-commercial offer

Type under MSE	SC/ST owned	Others
Micro		
Small		

Note: - If the bidder does not furnish the above, offer shall be processed construing that the bidder is not falling under MSE category.

MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM-II certificate having deemed validity (five years from the date of issue of acknowledgement in EM-II) or valid NSIC certificate or EM-II certificate along with attested copy of a CA certificate (format enclosed as Annexure – 3 where deemed validity of EM-II certificate of five years has expired) applicable for the relevant financial year (last audited). Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid). Non submission of such documents will lead to consideration of their bids at par with other bidders. No benefits shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazetted officer.

MSEs shall be exempted from payment of tender fee.

MSEs shall be exempted from payment of earnest money at the time of tender deposit. However, there is no exemption of security deposit submission.

30.0 The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendors/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice.

31.0 Order of Precedence

In the event of any ambiguity or conflict between the Tender Documents, the order of precedence shall be in the order below:

a. Amendments/Clarifications/Corrigenda/Errata etc issued in respect of the tender documents by BHEL
b. Notice Inviting Tender (NIT)
c. Price Bid
d. Technical Conditions of Contract (TCC)—Volume-1A
e. Special Conditions of Contract (SCC) —Volume-1B
f. General Conditions of Contract (GCC) —Volume-1C
g. Forms and Procedures —Volume-1D

for BHARAT HEAVY ELECTRICALS LTD
(SCT)

Enclosure:-

(i) Annexure-1: Pre Qualifying criteria.
(ii) Annexure-2: Check List.
(iii) Annexure-3: Chartered Accountant certificate for MSMED
(iv) Annexure-4: General Terms and Conditions of Reverse Auction (RA)
(v) Annexure-5: Authorization of representative who will participate in the online Reverse Auction Process
(vi) Annexure-6: Feedback form
(vii) Annexure-7: Integrity Pact
(viii) Other Tender documents as per this NIT.

ANNEXURE - 1

PRE QUALIFYING REQUIREMENTS

JOB.	**"Material handling, Erection, Testing, Commissioning, Trial operations & handing over of E&M packages including Kaplan turbines, Generators and its auxiliaries, Excitation Systems, Generator Transformers, C&I, EOT Crane, Fire Fighting System, VAC system etc. and providing other miscellaneous services for 4x16 MW Grand Katende Hydro Power Project, D R Congo".**
TENDER NO.	**BHEL / NR / SCT / D R CONGO / HTG / 1033**

SL. No.	PRE QUALIFICATION CRITERIA		Applicability
A	Submission of Integrity Pact duly signed		Applicable
B	Assessment of Capacity of Bidder to execute the work as per Sl. No. 9 of NIT		Applicable
C	**Technical:**		Applicable
	1.0	**Tenderers who wish to participate,** a) Should have **executed** during last 7 years ending last day of month previous to the one in which application is invited, at least two Hydro sets of any type (or combinations) as listed in C-1.01 to C-1.05, in which at least one Hydro set should have been **executed** in an Overseas Project. **or** b) Should have **executed** during last 7 years ending last day of month previous to the one in which application is invited, at least two Hydro sets of any type (or combinations) as listed in C-1.01 to C-1.05 and also should have **completed** during last 7 years ending last day of month previous to the one in which application is invited, at least one Overseas Project (s) involving erection and commissioning (E&C) of Mechanical/ Electrical/ Instrumentation works. **or** c) Should have **completed** during last 7 years ending last day of month previous to the one in which application is invited, Overseas Project(s) involving erection and commissioning (E&C) of Mechanical/ Electrical/ Instrumentation package as follows: • Three (3) **completed** works each of value not less than USD 1.98 Million 'or' • Two (2) **completed** works each of value not less than USD 2.475 Million 'or' • One (1) **completed** work of value not less than USD 3.96 Million. **(Note:** 1. **Completed** means Works defined in the scope of that particular work order/ contract should be complete. Partial completion of work shall not be considered. 2. Civil works (if any) associated with the Mechanical/ Electrical/	

		Instrumentation package shall also be considered as a part of the said package. 3. In case of composite package (Supply and E&C), where separate break-up of price for erection and commissioning portion is not mentioned, then the value of E&C portion shall be considered as 15**%** of the composite package**)**. This party shall be considered as Prime bidder. **And** Should have entered into a consortium agreement with a party who should have solely **executed** during last 7 years ending last day of month previous to the one in which application is invited, at least two Hydro sets of any type (or combinations) as listed in C-1.01 to C-1.05.	
	1.01	Pelton Hydro Turbine Generator set and its auxiliaries of 30 MW or higher rating.	
	1.02	Francis Hydro Turbine Generator set and its auxiliaries of 10 MW or higher rating.	
	1.03	Kaplan Hydro Turbine Generator set and its auxiliaries of 6 MW or higher rating.	
	1.04	Reversible Hydro Turbine Generator set and its auxiliaries of 10 MW or higher rating.	
	1.05	Francis Type Pump Motor set and its auxiliaries of 10 MW or higher rating.	
D 1.1	**FINANCIAL** **<u>Turnover</u>** Bidder must have achieved average annual financial turnover (audited) of USD 1.485 Million (INR 9.528 Crs.) or more during last three financial years (1st April to 31st March) i.e. (2012-2013, 2013-2014 and 2014-2015). Bidder shall submit audited accounts in USD or INR (balance sheets and profit and loss account) in English language signed by the directors and Chartered/Certified Accountant (with membership number mentioned in the document) in support of this. Wherever financial year does not end on 31st March, preceding accounting years comprising of 12 months period for 3 previous accounting years ending on or before 31st March, 2015 shall be considered. In case audited financial statements have not been submitted for all the three years as indicated above, then the applicable audited statements submitted by the bidder against the requisite three years, will be averaged for three years i.e. total divided by three.		Applicable
1.2	**Net worth:** Net Worth of the bidder based on the latest Audited Accounts as furnished for 'D 1.1' above should be positive. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated in case of companies)		Applicable
1.3	**Profit:** Bidder must have earned cash profit in any one of three financial/accounting years as applicable in the last three financial/accounting years defined in 'D 1.1' above based on latest Audited Accounts.		Applicable

	Profit shall be NET profit (Profit After Tax + Non cash expenditure viz. depreciation) earned during any one of the three financial years as in 'D 1.1' above.	
E	**Approval of Customer**	Applicable
F	**Consortium criteria in place of Standard Clause 23.0 of NIT** Consortium Criteria, if applicable shall be as follows: i) Prime Bidder and Consortium Partner are required to enter into a consortium agreement in English Language as per Form No. F-22 of NIT (Forms & Procedures), with a validity period of six months initially. Consortium agreement shall be signed by all partners, shall be submitted as a part of technical bid. The composition of the Consortium and role & responsibility of each Partner must be defined in the agreement especially about the type of arrangement between the two Partners in ensuring the completion of the job. In case the consortium is awarded the contract, then the Consortium Agreement between the Prime Bidder and Consortium Partner shall be extended till contractual completion period including extension periods, if any. ii) Prime Bidder and Consortium Partner shall have to be individually approved by Customer for being considered for the tender. iii) The number of partners including the prime bidder shall not exceed two. iv) Prime Bidder and Consortium Partner shall together comply with the Pre-Qualification criteria Sl. No. C- 1.0. (c). v) The financial criteria as mentioned in section D shall be exclusively complied by the Prime bidder. vi) Prime Bidder shall be responsible for overall completion of the Contract. vii) In case of award of job, Performance shall be evaluated for Prime Bidder and Consortium Partner for their respective scope of work(s) as per prescribed formats. viii) Prime Bidder shall be authorized to incur liabilities and receive instructions for and behalf of Consortium Partner and the entire execution of the contract, including payment shall be done exclusively with Prime Bidder. ix) In case the Consortium partner back out, its SDs shall be encashed by BHEL. In such a case, other consortium partner meeting the PQR have to be engaged by the Prime Bidder, and if not, the respective work will be withdrawn and executed on risk and cost basis of the Prime Bidder. The new consortium partner shall submit fresh SDs as applicable. x) In case Prime Bidder withdraws, the whole contract shall be terminated and action shall be taken in line with other clauses of NIT. xi) After completion of work, the work experience shall be assigned to the Prime Bidder and the consortium partner for their respective scope of work. After successful completion of two similar works with the same consortium partner under direct orders of BHEL, the Prime Bidder shall be eligible for becoming a 'stand-alone' bidder for similar works, subject to certification from BHEL about the active involvement of the Prime Bidder for satisfactory execution of the works. xii) The consortium partner shall submit SD equivalent to 2% of the total contract value in addition to the SD to be submitted by the prime Bidder for the total contract value. xiii) 'Stand-alone' bidder cannot become a 'Prime Bidder' or a 'Consortium bidder' or 'Technical Tie up bidder' in a consortium (or Technical Tie up) bidding. Prime bidder shall neither be a consortium partner to other prime bidder nor take any other consortium partners. However, consortium partner may enter into consortium agreement with other prime bidders. In case of non-compliance, consortium bids of such Prime bidders will be rejected.	Applicable

Explanatory Notes for PQR 'C'

1. The term **executed** means completion of Erection and Commissioning up to (at least) Spinning of Units up to

rated speed.

2. Tenderer shall submit documents in support of meeting the respective Qualifying Requirement.
3. Consortium shall be only considered for Pre-Qualification criteria Sl. No. C- 1.0. c). Prime Bidder and Consortium Partner shall together comply with the Pre-Qualification criteria Sl. No. C- 1.0. c)
4. **Completed** means: Works defined in the scope of that particular work order/ contract should be complete. Partial completion of work shall not be considered. Bidder has to submit the Work/contract completion certificate from Client for that particular work order/contract(s).
5. If the qualifying work is **completed/executed** in the seven (7) years period specified above, even if started earlier, the same will also be considered meeting the qualifying requirements.
6. For valuation, the completed value of the Project (s) will be considered in USD as on the date of completion mentioned in the certificate of client (as per SBI rates on web page).

BIDDER SHALL SUBMIT ABOVE PRE-QUALIFICATION CRITERIA FORMAT, DULY FILLED-IN, SPECIFYING RESPECTIVE ANNEXURE NUMBER AGAINST EACH CRITERIA AND FURNISH RELEVANT DOCUMENT INCLUSIVE OF WORK OREDER AND WORK COMPLETION CERTIFICATE ETC IN THE RESPECTIVE ANNEXURES IN THEIR OFFER.

ANNEXURE - 2

CHECK LIST

NOTE:- Tenderers are required to fill in the following details and no column should be left blank

1	Name and Address of the Tenderer			
2	Details about type of the Firm/Company			
3.a	Details of Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:		
3.b	Details of alternate Contact person for this Tender	Name : Mr/Ms Designation: Telephone No: Mobile No: Email ID: Fax No:		
4	EMD DETAILS	DD No: Date : Bank : Amount: Please tick (√) whichever applicable:- ONE TIME EMD / ONLY FOR THIS TENDER		
5	Validity of Offer	TO BE VALID FOR SIX MONTHS FROM DUE DATE		
			APPLICABILITY (BY BHEL)	ENCLOSED BY BIDDER
6	Whether the format for compliance with **PRE QUALIFICATION CRITERIA** (ANNEXURE-I) is understood and filled with proper supporting documents referenced in the specified format		Applicable	YES / NO
7	Audited profit and Loss Account for the last three years		Applicable/~~Not Applicable~~	YES/NO
8	Copy of PAN Card		Applicable(for Indian bidders)/~~Not Applicable~~	YES/NO
9	Not Used			
10	Integrity Pact		Applicable/~~Not Applicable~~	
11	Declaration by Authorised Signatory		Applicable/~~Not Applicable~~	YES/NO
12	No Deviation Certificate		Applicable/~~Not Applicable~~	YES/NO
13	Declaration confirming knowledge about Site Conditions		Applicable/~~Not Applicable~~	YES/NO
14	Declaration for relation in BHEL		Applicable/~~Not Applicable~~	YES/NO
15	Non Disclosure Certificate		Applicable/~~Not Applicable~~	YES/NO
16	Bank Account Details for E-Payment		Applicable/~~Not Applicable~~	YES/NO
17	Capacity Evaluation of Bidder for current Tender		Applicable/~~Not Applicable~~	

18	Tie Ups/Consortium Agreement are submitted as per format	Applicable/~~Not Applicable~~	YES/NO
19	Power of Attorney for Submission of Tender/Signing Contract Agreement	Applicable/~~Not Applicable~~	YES/NO
20	Analysis of Unit rates	Applicable/~~Not Applicable~~	YES/NO

NOTE: STRIKE OFF 'YES' OR 'NO', AS APPLICABLE. TENDER NOT ACCOMPANIED BY THE PRESCRIBED **ABOVE APPLICABLE DOCUMENTS** ARE LIABLE TO BE SUMMARILY REJECTED.

DATE :

AUTHORISED SIGNATORY
(With Name, Designation and Company seal)

ANNEXURE - 3

Certificate by Chartered Accountant on letter head

This is to Certify that M/S ..... , (hereinafter referred to as 'company') having its registered office at ..... is registered under MSMED Act 2006, (Entrepreneur Memorandum No (Part—II) ..... dtd:..... , Category: ..... (Micro/Small)). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as per the latest audited financial year..... as per MSMED Act 2006 is as follows:

1. **For Manufacturing Enterprises:** Investment in plant and machinery (i.e. original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No. S.O.1722(E) dated October 5, 2006:
   Rs.....Lacs

2. **For Service Enterprises:** Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the **MSMED** Act, 2006:
   Rs.....Lacs

(Strike off which is not applicable)

The above investment of Rs.....Lacs is within permissible limit of Rs.....Lacs for ..... Micro / Small **(Strike off which is not applicable)**

Category under MSMED Act 2006.

Or

The company has been graduated from its original category (Micro/Small) (Strike off which is not applicable) and the date of graduation of such enterprise from its original category is ..... (dd/mm/yyyy) which is within the period of 3 years from the date of graduation of such enterprise from its original category as notified vide S.O. No. 3322(E) dated 01.11.2013 published in the gazette notification dated 04.11.2013 by Ministry of MSME.

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant

ANNEXURE - 4

GENERAL TERMS AND CONDITIONS OF REVERSE AUCTION (RA)

Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

1. For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.

2. Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit "online sealed bid" in the Reverse Auction. Non submission of "online sealed bid" by the bidder for any of the eligible items for which techno commercially qualified, will be considered as tampering of the tender process and will invite actionby BHEL as per extant guidelines in vogue.

3. BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.

4. In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.

5. Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.

6. Bidders have to fax the Compliance form before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.

7. In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.

8. Reverse auction will be conducted on scheduled date & time.

9. At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.

10. The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, as provided on case-to-case basis to Service provider within two working days of Auction without fail.

11. In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL"s standard practice.

12. Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the

"Business Rules of Reverse Auction", which will be communicated before the Reverse Auction.

13. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines*, shall be initiated by BHEL and the results of the RA scrapped/ aborted.

14. The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.

15. In case BHEL decides to go for reverse auction, the H1(s) bidder (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

ANNEXURE – 5

Authorization of representative who will participate in the on line Reverse Auction Process;

1	NAME & DESIGNATION OF OFFICIAL	
2	POSTAL ADDRESS (COMPLETE)	
3	TELEPHONE NOS. (LAND LINE & MOBILE BOTH)	
4	FAX NO.	
5	E-MAIL ADDRESS	
6	NAME OF PLACE/ STATE/ COUNTRY, WHEREFROM S/HE WILL PARTICIPATE IN THE REVERSE AUCTION	

ANNEXURE – 6

Feedback Form: From where did you get information reg. this tender

1	NEWSPAPER ADVERTISEMENT (NAME)	
2	BHEL WEBISTE (TENDER NOTIFICATION)	
3	CENTRAL PUBLIC PROCUREMENT PORTAL OF GOVERNMENT OF INDIA (CPP PORTAL)	
4	EMAIL COMMUNICATION FROM BHEL	
5	ANY OTHER SOURCE	

INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi – 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in

order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidders(s)/ Contractor(s) from the tender process or take action as per the separate “Guidelines for Suspension of Business Dealings with Suppliers/ Contractors” framed by the Principal.

Section 4 – Compensation for Damages

4.1 If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to demand from his sub-contractors a commitment consistent with this Integrity Pact. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal.

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 –Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or

take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

----------	----------
For & On behalf of the Principal	For & On behalf of the Bidder/ Contractor
(Office Seal)	(Office Seal)

Place----------

Date----------

Witness: _____	Witness: _____
(Name & Address) _____	(Name & Address)_____
_____	_____

Rev 01
1st June
2012

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART-I

(Document No PS:MSX:TCC)

BHARAT HEAVY ELECTRICALS LIMITED

1. Project Information

1.1. Introduction

Democratic Republic of Congo, represented by H.E. TSHIONGO TSHIBINKUBULA wa TUMBA Gilbert Ministry of Energy (GODRC) has placed an order to BHEL-AIL CONSORTIUM comprising of Bharat Heavy Electricals Limited (BHEL), a company incorporated under the laws of India and having its registered office at BHEL House, Siri Fort, New Delhi 110049, India & M/s Angelique International Limited (AIL), a company incorporated under the laws of India and having its Registered office at 104-107 Hemkunt Tower, 1st Floor, 98 Nehru Place, New Delhi, India for realization of detailed design, engineering, supply of equipments, installation and construction of the Grand Katende Hydropower Project (4x16 MW) in the province of Kasai Occidental as well as the supply of materials of transmission line.

BHEL has been entrusted the work of design, manufacture, supply, Erection, Testing & Commissioning of the E&M Packages of 4x16 MW GRAND KATENDE HYDROPOWER PROJECT (HEP) located in D R CONGO.

Grand Katende Hydropower Project is a run-off river scheme located on the Lulua River (tributary of the right bank of Kasai River) in the province of Kasai Occidental, which involves a weir that blocks the river falls to the right of Laula River and directs water into the intake power pool.

Surface power house site is located in the province of KASAI OCCIDENTAL which is 80 km from Kananga (Chief town of province), 130 km west of Mbuji-Mayi, 820 km in the east-south of capital KINSHASHA.

Entire project area including powerhouse, switchyard, closed storage shed, open store, etc. are situated in a campus near to Bunkunde.

Stores: Open store of area approx. 4000 sqm., closed storage shed of approx. 600 sq.m, semi closed storage shed of approx.. 400 sq.m and are situated near BHEL office in the campus and approx. 500 m from the powerhouse.

Switchyard: Switchyard is located near to the service bay at a distance of approx. 100m.

Transport and Gateway to Kasai Occidental: The bidder may note that the roads for transportation and communications with the territory of two provinces are in poor condition. The sea port for import of overseas material to site is Dar - es – Salaam. Then,

the material has to be transported to Lubumbashi via Kasumbalesa by road, from Lubumbashi to Tshimblu by train and from Tshimblu to Site by road.

1.2. **Climatic Conditions:**

Climate:

The DRC is located between the 5th parallel north and 13th parallel south (of which two third are concentrated heavily between the fourth and eighth parallel south) and 12th and 31st meridian east.

There is dry season in the south (in which site is located) in the middle of the year. The equatorial region has almost all year round warm and humid climate. Wet and heavy rain with thunderstorms.

The south (Katende) in April, May or June to August, September or October, so known a dry season of much longer as they are away from the equator.

Rainfall and humidity

The average annual rainfall near to site is between 1400 mm to 1600 mm.

The regime of the Lulua is of type tropical storm two main seasons: Heavy rain from Novemebr to March, except for “short dry season” in January or February. The main dry season from May to September with a low flow generally from July to September.

Humidity of air: annual daily average is 85% national wide, 70% to 75% at its southern borders.

Air temperature

Average annual temperature is 19 ° C at low altitude and 14 ° C at high altitude. Near site, during dry season (May-September) night temperature can drop to 5 ° C.

2. Scope of Work

2.1. **Scope of these specifications cover complete works for following E & M packages:**

List of equipments under E&M Packages:

1. 4 sets of Pier Nose Liners
2. 1 lot of pipes and embedment in 1st stage for all four units
3. 4 sets of DT Elbow Liners
4. 4 sets of D T Cones
5. 4 sets of embedded tubes for field efficiency testing
6. 4 set of stay ring (RCC spiral casing by civil contractor)
7. 1 lot of embedment and pipes in 2nd stage for all four units
8. 4 sets of vertical Kaplan Turbines & accessories
9. 4 sets of Governing System & accessories
10. 4 sets of Oil Pressure System
11. 4 sets 11kV, 50 Hz, 3 phase, umbrella type Generator & auxiliaries system with closed air circuit ventilation.
12. 1 lot of CO_2 type fire extinguishing system for generators for all four units
13. 4 sets of Voltage Regulation & Excitation system including dry, cast resin type excitation transformer and accessories.
14. 4 sets of 11 KV Segregated Phase Bus Cables including CTs & VTs, LAVT & NG cubicles and galvanized steel structures.
15. 4 Nos. 20 MVA, 11/132 kV, 3ϕ GSU Transformers & accessories.
16. 1 no. 5 MVA, 132/11 kV, 3ϕ Station Transformer
17. 4 nos. 500 kVA, 11/0.415 kV Unit Auxiliary transformers
18. 1 no. 1000KVA, 11/0.415KV Station Service Transformer (SST) with set of fittings.
19. 1 lot Control & Monitoring System
20. 1 lot Protection System
21. 1 lot AC Auxiliaries (LTAC) system for Powerhouse
22. 1 lot DC System for Powerhouse
23. 1 lot of cable and cabling system for Powerhouse.
24. 1 lot of 11 kV Switchgear System
25. 1 set of Cooling Water System for complete powerhouse
26. 1 set of Drainage & Dewatering System
27. 1 set of HP Compressed Air System for complete Powerhouse
28. 1 set of LP Compressed Air System for complete Powerhouse
29. 1 lot of Fire Detection & Fighting Protection System for PH and Switchyard**
30. 1 no. EOT cranes of 110/10T capacity including load testing (load to be provided by AIL)**
31. 1 no. 10T semi EOT /Electric Hoist for Mechanical Workshop area**
32. 1 lot of Ventilation & Air Conditioning System**
33. 1 lot of Workshop equipments**

34. 1 no. Elevator**
35. 1 no. 500 kVA Silent DG set**
36. 1 lot of Oil Handling System-Lubricating Oil
37. 1 lot of Oil Handling System- Insulation Oil for Transformers.
38. 1 lot of Instruments i.e. Turbine Discharge Measuring Equipments, Head race & tail race measuring equipments etc.
39. Starter panels for turbine & generator auxiliaries.
40. 1 lot of Telephone/Communication System**
41. Other miscellaneous Mechanical/Electrical assemblies
42. 1 lot of equipments earthing system
43. Extended support for conducting Field efficiency testing of generators & turbines
44. Any other items not covered above but required for project completion.

** Supervision of erection/commissioning of these equipments shall be done by BHEL's concerned Manufacturing Unit's vendor(s) representatives.

2.1.1. Material handling:

Unloading of material **in stores**, on arrival from India shall be done **by AIL (our consortium partner and shall not be in the scope of this contract).**

Material handling at site under this scope includes storage/re-storage(if required) on receipt of all the incoming materials/already unloaded materials of all the above E&M packages, material verification & record keeping (maintain stock register, DB register, material issue register etc. both in hard copy and soft copy), reporting of damages/shortages, providing necessary assistance for insurance claim settlement process, proper storage (stacking & preservation as per instructions), shifting & re-stacking (if required) of material to open/ closed storage yards/sheds during storage, Loading & Transportation of material to power house/ work front and unloading thereof. Handing over of spares & surplus material to customer and material reconciliation after completion of erection and commissioning of the project shall also be in the scope of the contract.

The materials to be handled under the scope shall be approximately **4400 MT**. The details of total materials are per **Chapter- IV, Part-I of TCC**.

Note:

1. On arrival of material at site from supplying BHEL units, the same shall be unloaded by other agency in the stores (Unloading at site stores is not covered in this scope), however those equipments/ packages which are to be directly unloaded in power-house/erection front upon its arrival at site from India, shall be done by the contractor under this scope of work.

2. The total weight of the material to be handled is tentative and may vary during detail design.
3. Rate for transportation of materials / equipments including loading either from project open store/closed storage shed/other storage area to power house/other work front, unloading with EOT Crane/Mobile Crane and handing over for erection, will be same.

4. Entire material handling for all materials will be the responsibility of contractor and shall be paid as per Sl. No. 2 (a) and 2 (b) of Rate Schedule.

5. Some incoming consignments from MUs may be required to be directly unloaded in the Power house. The contractor shall have to unload directly in Power House on instructions of BHEL engineer. The payment rate schedule 2(b) shall be applicable for this activity.

6. Some materials may be required to be dispatched back from Site to Manufacturing Units, other sites or any other place, the contractor may be asked by the engineer to get the same packed, loading on to the truck for further dispatch. The payment rate schedule 2(b) shall be applicable for this activity.

7. In case of unavailability of EOT crane in P/H for any reason, Mobile crane/Hydra required for material handling in Powerhouse/ work site shall be arranged by contractor at his own cost.

2.1.2. <u>Erection & Commissioning:</u>

Pre-erection assembly, erection, testing (including hydraulic, NDT, electrical, stage & final HV including dry out, core flux /ELCID test of generator stator etc. of relevant equipments at various stages during erection), pre-commissioning and commissioning including trial run, handing over to Ministry of Energy, Democratic Republic of Congo, of the following equipments/systems for four units of 4x16 MW Katende HEP of rating 15.1 metres head, 125 RPM clockwise vertical Kaplan type Hydro Turbines, Umbrella type hydro generators, auxiliaries and all other associated equipment. The total materials are to be erected are approximately 4400 MT.

Note:

EOT crane in powerhouse shall not be available for erection of 1st stage embedments & Pipes, Draft Tube liners, Pier Nose Liners etc. Erection of the same is required to be done with 10 T Hydra Crane to be provided by AIL free of hire charges only for these activities.

However, running cost and operator shall be in contractor scope. Other alternate arrangement, if required for the above, same shall be in the contractor scope.

Brief details of major equipment are as given below:

1. Turbine- as per BRIEF DESCRIPTION OF TURBINE below.

2. Speed Governors & Oil Pressure system consisting of Electronic Governor System, Governor Hydraulic System, and Position feedback devices, speed sensing device and hydraulic over speed device comprising of hydro mechanical cabinet & EHGC, complete Oil pumping system with oil leakage units, oil level relays, oil sump tank, oil pressure vessel, first filling of oil, pressure transmitters, Electrical transducers, emergency slide valve, flow meter, Temperature scanner, oil level indicator & controller etc.

3. Head/tail race measuring equipment and feedback mechanism along with piping and associated equipment.

4. Lubrication oil system having Oil filtration plant & oil transfer pump will consist of a positive displacement type Gear Pump with horizontal driving shaft directly coupled/connected to its electric motor through flexible coupling.

5. Generator- as per BRIEF DESCRIPTION OF GENERATOR below.

6. Microprocessor based Excitation systems and AVRs consisting of 4 nos. 11/0.395 kV, three phase, excitation transformers, AVRs, rectifier system, power supply units, field flashing circuits , field circuit breaker with discharge resistor, digital control and metering equipment, JB's and its wiring etc. along with associated equipment.

7. XLPE cables mainly comprising mainly for main run, tap off run for SPVT, NG, UAT and Excitation transformer, galvanized steel structures, earthing switches etc along with various rubber bellows, seal off bushings, CTs, PTs and other associated equipment.

8. Generator transformers 20 MVA, 11/132 kV three phase along with set of valves, piping, hangers, hardware, ONAN/ONAF cooling system consisting of radiators & shut-off valves, oil, rails & rollers and other associated equipment. All the 4 nos. transformers including to be installed in transformer cavern. All site tests except HV test shall be conducted at site. The connection on HV side of the Transformer

to the 132 kV overhead lines shall be done by other agency and **not** in the scope of this work.

9. Station transformers: 1 no. 132/11kV, 5 MVA, 3ϕ, Power transformer along with set of valves, piping, hangers, hardware, ONAN/ONAF cooling system consisting of radiators & shut-off valves, oil , rails and other associated equipment. All site tests except HV test shall be conducted at site.

10. Unit auxiliaries transformer: 4 nos. 500 kVA, 11/0.415 kV, three phase cast resin dry type transformer with set of fittings.

11. Station Service Transformer (SST): 1 no. 1000KVA, 11/0.415KV DTT with set of fittings.

12. D.C. System: - D.C. system comprising battery banks, charger, DC distribution board, 220VDC/415V AC invertor etc.

    48V DC system comprising battery banks, charger, DC distribution board, Incoming feeder, Outgoing feeder & specified spares.

13. Control & Monitoring system (SCADA) consists of Control Boards comprising of Local control Board (LCB/UCB) for each generating units, LCB for common station aux. & switchyard. Computerized Control Equipment (HMI) in Control Room (CR) comprising of operator work station computer sets and accessories, Plant Network for data exchange between UCBs, LCBs, computer and printer, 230 VAC UPS with redundant electronics and common sealed maintenance free battery bank for power supply requirements of computers, transducers, DM printers and 24 V DC Battery system.

    Individual units control comprising of auto sequencer, facility of individual drive operation and alarm annunciation system are provided. Temperature measurement panel, instrument and gauge panels are provided to give comprehensive view of the operating parameters of the plant.

    LCB for common station auxiliaries & switchyard is provided for control & monitoring of common station auxiliaries & Switchyard.

    Commissioning of all this system shall be carried out by BHEL engineers. However, erection of associated cabling works including OFC in Power House & equiments and all assistance for Pre commissioning and commissioning for the same shall be covered under the scope of this contract.

14. Protection system for Generator, Generators transformers & UATs, each comprising of steel cubicle, numerical multi-functional generator protection relay, numerical overall differential protection relay, numerical GT backup E/F protection relay type, numerical UAT backup E/F protection relay, numerical REF and over current protection relay, set of universal relay test block, set of VT fuse failure relay etc.

15. One lot of grounding system for PH area including Underground Earthing Network for Transformer Hall, Powerhouse, Tail Race and other adjoining functional areas and Over ground Earthing Network for Transformer Floor, Generator Floor, all other floors of Powerhouse, any other areas where earth fault current may flow shall be in AIL scope. However, connections of risers earthing to equipment /panels shall be in the scope of this contract.

16. Power, control and instrumentation cables complete with cable terminals, accessories, trays/ support structures, cabling/wiring, proper dressing, identification tags, clamping of cables on trays for all the hydro generating equipment, transformers, bus ducts, along with associated items & auxiliaries. BUT excluding the cabling for switchyard & transmission line, few BOPs namely EOT Cranes, Fire Fighting System, illumination system, VAC system, elevators, communication system.

    Type and size of cable will be finalized during detail design. Complete scope of cabling shall be in the scope of Contractor.

    Lugs and Glands supplied by Manufacturing Unit, will be released to contractor free of cost. Additional quantities (if required) of lugs up to 2.5 sq.mm, ferrules & sleeves for cable termination and cable ties are in the scope of contractor. The contractors shall have to arrange ferrule printing tubes (for cable upto 4sqmm) and ferrule printing machine required for cabling work shall be in contractor scope.

17. 11 kV, 400 A, 12.5 kA switchgear comprising of incoming feeder, bus bar, transformer feeder, set of earthing breakers with alarm scheme & set of accessories.

18. 415V Switchgear comprising 4 nos. Unit Auxiliaries Boards (UABs) each comprising of 3 nos. 415V, 800 A, Air Circuit Breaker, MCCB, bus bars, relay voltmeter ,

Ammeter etc., 1 no. SSB comprising of 415V, 1600A, air circuit breaker, MCCB. ACB, bus bars etc.

19. One set of cooling water system for complete power house for supplying water to turbine and generator use. The cooling water shall be taken from tailrace. The system shall comprise of a total eight pump-motor sets (two pump motor sets for each unit- one main and other standby), four automatic self-cleaning strainers (one for each unit), necessary valves, pressure gauges, pipings, support etc. The pump discharge lines shall be connected to a common header. Cooling water to individual unit shall be supplied from this header. The cooling water shall be discharges into tailrace above MAX. TWL.

20. Drainage & Dewatering System: Drainage system of clear water having submersible drainage pumps of adequate capacity to remove normal seepage and leakage alongwith necessary pipings, valves and fittings. Level controllers to start/stop the motors shall be provided.

    Dewatering system: one turbine dewatering system shall be provided for dewatering all hydraulic passage of turbines. The individual draft tube shall be connected to the common discharge header, through dewatering gallery through pipe and isolating valve from where water shall be led to tailrace. It shall have pumps of adequate capacity, complete with adequate nos. of non-return valves, isolating valves, pressure gauges, piping, fittings, support etc. The drainage water shall be pumped out through discharge header and finally into tail race above maximum flood level.

21. One set of HP Compressed air system for complete power house for supplying pressurized air to governing oil system of turbine and MIV and generator brakes. It comprises of two reciprocating air compressor-motor sets, air dryers, HP air receiver for turbine and MIV with necessary fittings & instruments, one set of pressure reducer valves, necessary valves, drain traps, seamless pipings, fittings and supporters etc. it has also one set of instruments and safety devices along with one set of specified spares.

22. One set of LP compressed air system for complete power house for intermittent supply of air to cater the needs of generator brakes system, turbine shaft seal and power house services like drinking water, Cooling water, workshop, firefighting etc. The system shall comprise two air compressor motor sets (one main other standby), two air dryers, one air receiver, pressure switches, necessary valves,

pressure gauge, drain traps, piping, fittings etc. the HP compressed air system shall be connected to LP compressed air system through a pressure reducing valve.

23. There shall be separate oil Handling System for insulating and lubricating oil. It shall consist of Trolley Mounted oil tank and Oil Filtration Plant consisting of vacuum pump/dryer, oil hoses, and evacuation system.

BRIEF DESCRIPTION OF TURBINE

1. TURBINE SYSTEM

A. Embedded parts:

The embedment & foundation parts to be embedded in concrete structure comprise mainly of Draft Tube Elbow Liners, pier nose liners, Draft tube cone assembly, Runner envelope assembly, Stay ring assembly, Pipes & embedment in 1st stage, Pipes & embedment in 2nd stage, Pit Liner assembly, field efficiency pipes etc.

Draft Tube Elbow Liners:

The draft tube elbow liner assembly weighing approx. 42 MT with inlet diameter 5075 mm and elliptical outlet section having length of major axis and minor axis are 15100 mm and 2950 mm respectively. It is fabricated from 10 mm thick steel plate and is supplied in segments that are to be assembled and welded at site for embedment in concrete after installation. Holes of Φ200 mm are provided in the lower portion of the liner for concrete purposes which are to be plugged at site later. Holes of dia 12 may be required to be drilled for air release/ venting and grouting requirement. Cleaning and flushing of all spots from where these fixtures are removed, are to be done.

All butt weld joints and plugs shall be checked by 100 % Dye Penetration during erection. Holding down bolts and legs have been foreseen for pedestals erection of draft tube elbow liners of each unit. Cleaning and painting of the assembly is required to be done after completion of civil works.

Pier Nose Liner:

Each unit shall have two pier nose liners (right & left) and each of pier nose liner shall be supplied in segments, which are to be welded together at site during

erection. The assembly weights about 14 MT. The liner is adequately braced and provided with base pads and leveling screws for adjustment during the installation.

Draft tube cone:

The draft tube cone is of steel structure comprises top and bottom cones. Top cone shall be supplied in segments weighing approx 1.5 tons and shall be assembled & welded together. On the top, top cone is bolted to runner envelope and at bottom, it is bolted with bottom cone. Bottom cone shall also be supplied in segments weighing approx 5.5 tons and shall be assembled & welded together. On the bottom it is bolted to DT Elbow liner. Top and bottom I/D of DT cone are approx. 4350 and 5100 mm respectively. Total weight of D/T cone assembly is approx. 8.5 MT.

B. Foundation Parts:

Pit Liner:

It shall be steel fabricated structure and supplied in segments. They are to be assembled and welded together and to stay ring at site. The pit liner assembly is approx. 6650mm in diameter, 4500mm in height and weight approx. 12 MT.

Stay Ring:

The stay ring shall be fabricated from welded steel plates and have set of streamlined stay vanes with overall diameter 6600 mm and height of 3000 mm. The weight of the assembly shall be approx. 35 MT and shall be supplied in segments that are to be assembled together at site. The top ring is designed to carry the top cover & pit liner assy. and lower ring to carry the pivot ring. The site weld joints shall have to be DP & MPI tested for release of assembly for concreting

Runner Envelope:

It shall be fabricated structure from mild steel/stainless steel. The runner envelope assembly diameter is approx. 4500mm and shall be supplied in two segments that are to be assembled & welded together at site. The total weight of runner envelope assembly shall be approx. 28.5 MT. The site weld joints shall have to be DP & MPI tested for release of assembly for concreting.

Runner:

The adjustable blade Kaplan runner shall be comprising of 4 cast steel stainless steel blades each weighing 2.5 tonnes. The blades shall be integral with trunnion. The

runner hub shall be cast steel in single piece of weight 11 MT. Blade turning mechanism consisting of a powerful servomotor for blade turning mechanism shall be housed inside the runner hub. A mild steel runner cone in three pieces (upper, middle and lower cone) total weighing approx. 2.75 tonnes shall be bolted to hub to guide the water as it leaves the blade. The cone shall have end cover and access cap. Total weight of complete runner assembly shall be approx. 30MT. Runner assembly and testing to be done at site in accordance to the drawings.

Turbine shaft:

The turbine shaft nominal dia shall be approx. 570 mm with flanges at both ends, one end shall be bolted to runner at Turbine end with shear bush and fitted bolt of M90. And other end to the Generator shaft by spigotted coupling and fitted bolts of M80. The length of shaft shall be approx. 6450 mm and weight approx. 13.5 MT. Total weight of turbine shaft arrangement shall be approx. 14.5MT. The shaft shall be provided with an integral forged forming the guide bearing journal. Special Tools & Tackles required for handling Runner-Shaft assembly shall be supplied for handing over to the customer. The Runner- Turbine shaft assembly shall have to be tested in service bay before lowering in the Turbine pit.

Oil header and Oil Tubes:

Oil header weighing approx. 6.5 tons shall be mounted on the top of the generator and shall incorporate parts for supplying the oil to the runner blade servomotors through oil tubes. It shall be complete with special piping passing down the bore of main shaft to the runner. It shall also house the connecting rope for feedback mechanism assembly.

Turbine guide bearing

Turbine Guide bearing shall be submerged, self-oil lubricating, pivoted pad type with cooling arrangement. The bearing shall be housed in the Inner Top cover located above the turbine runner. The TGB assy. shall have necessary instrumentations.

Turbine shaft sealing:

There shall be arrangement of Turbine shaft sealing to prevent leakage of water through the gap between the Shaft and Turbine top cover. The Turbine shaft sealing assembly shall be located below the guide bearing. Two rubber sealing rings shall be housed in the sealing housing supplied in two halves.

C. Guide Apparatus and Servomotors Assembly:

Top Cover:

The top cover guides water axially into the runner and serves as a support for the guide bearing, shaft seal gland, and guide vane operating mechanism. It shall be fabricated in two parts viz. outer top cover and inner top cover and connected to each other by sufficient nos. of parallel dowel.

Outer top cover shall be supplied in segments weighing about 18.5 MT and inner top cover is supplied in halves weighing approx. 21 MT.

Pivot Ring:

The pivot ring shall be fabricated from steel plates, supplied in segments weighing approx. 10 tons. The ring shall be bolted to stay ring and self-lubricating bearing bush shall be housed in it for the lower stem of guide vanes. Fixed type stainless steel wearing plates shall be welded to it below the guide vanes.

Guide Vanes:

24 no. guide vanes of feather height approx 1950 mm are located at PCD of 5400 mm. Regulating ring shall be located inside the guide vane PCD. The guide vanes shall be fabricated shall be fabricated from steel plates and welded to trunnion.

Regulating Ring:

Regulating ring shall be welded stress relieved steel assembly supplied in two sections weighing approx. 7 tons. The regulating ring shall be supported on top cover. The Regulating ring shall provide linkage for connection to the guide vanes servomotors & the Guide vanes

Guide Vane Servomotors:

The guide vanes shall be operated/controlled by two double acting oil operated servomotors. The servomotor assy. shall be complete with piston, piston rings, stuffing boxes, connecting rods, pins etc.

D. Other standard assembles

Various other assembles like feedback system, oil pumping system, oil air receives, oil leakage unit etc. as generally provided in hydro project are all foreseen but not mentioned above shall be erected at site.

E. Feedback mechanism

It comprises of wire rope mechanism and LVDT to transmit signal of position/movement of nozzle servo motor (opening/closing) to the hydro mechanical cabinet (HMC) of governor.

F. Oil, Water & Air pipelines

Laying and clamping /supporting of Oil pipe lines, Water pipe lines and Compressed air pipe lines shall be shown indicative in respective drawing which can be decided to suit site condition. Pipes shall in general be supplied in straight lengths and to be bent at site as per requirement. For medium and large size pipes, regular bends may not be supplied and therefore bends shall have to be fabricated at site within the quoted rates .The pipes are to be welded & tested at site as per drawing. All welds are to be tested as per drawing requirements. All pipes are to be hydraulically tested at site after welding. All Oil pipelines are to be cleaned by acid picking. Oil flushing has be done for Governor Pipelines and other oil pipelines. Cleaning/flushing of pipelines are to be carried out as per drawing requirement/ instruction.

G. Other Miscellaneous Mechanical assembly

Other miscellaneous mechanical assemblies like, hatch covers, and platform and ladders etc. are envisaged that are to be fabricated and erected at site.

BRIEF DESCRIPTION OF GENERATOR:

General description of various assemblies:

The rating of Hydro Generator Shall be 18 MVA, 50 Hz, 11 kV, 3 phase, Class F insulation, 125 rpm (clockwise viewed from top). The generator shall be a vertical shaft umbrella type having salient poles with closed air circuit ventilation and suitable for coupling to a Kaplan turbine.

Stator

The stator frame shall be dispatched to the site in segments. The outer A/F dimension of stator frame shall be 9500 mm approx. complete core building and stator winding shall be done at site. The diameter and height of stator core assembly shall be approx. 8000 mm and 430mm respectively. The core flux test/ ELCID test, the HV test and other site tests shall be carried out on the stator during assembly at

the site. The Core flux test kit/ ELCID test kit shall be arranged by BHEL. The Stator core building tools shall be supplied.

Anti-Condensation heaters

Low temperature heaters to prevent condensation on windings during periods of shutdown will be mounted suitably inside the barrel. They shall be of box type construction.

Rotor

The rotor consists of spider assembly, rim assembly, rotor poles, fan assembly etc. The bottom shaft shall be coupled with the spider assembly at the bottom end. The top of the spider assembly shall be coupled with tubular shaft.

The Rotor spider shall be a fabricated structure having central assembly and 12 arms that are to be joined at site on which rotor rim building shall be done. The rotor rim assembly shall be built by stacking sheet steel laminations in several staggered layers, around the spider at site. All the laminations shall have to be degreased, cleaned, de-burred, segregated by weight and accordingly assembled. This ensures uniform weight distribution which is a necessity. After assembly, the laminations shall be clamped between steel end plates using rim studs and nuts. The rim is secured to the spider using a 5-key arrangement at each of the spider's key bars. The Rotor rim height shall be approx. 650 mm. There are 48 poles to engage with the corresponding slots in the rotor rim. The weight of each wound pole shall be approximately 275 kg. Rotor rim building tools & rotor pole handling devices shall be supplied. The Top & Bottom axial fans consisting of 48 segments each shall be bolted onto the rim end plates. The weight of assembled Rotor assembly shall be approx. 100 MT. Rotor lifting device shall be supplied for lifting and lowering of Rotor assembly in Generator pit.

Shaft and thrust bearing collar

The generator shaft shall have nominal diameter 570 mm, length 3820 mm and weight 15 MT approx. The thrust bearing collar and guide bearing journal will be integrally forged on the shaft. It shall have an integrally forged coupling flanges for connection with turbine shaft flange and Rotor spider assembly.

Slip Rings & Brush Gear

The slip rings shall be mounted on the top of tubular shaft. The brush gear assembly shall be mounted on insulated stud, both the Slip rings & brush gear shall have 'F' class insulation system.

Bearings:

Thrust Bearing Assembly: The Thrust bearing assembly shall be positioned below the rotor in bottom bracket. Thrust bearing is of spring mattress type consisting of a set of 10 thrust pads. The bearing is of self-lubricating type and immersed in oil bath in which plug-in type of oil coolers are provided. The Thrust bearing assy. shall have necessary instrumentations.

Guide Bearing Assembly: The Guide bearing shall be segmental pad type, provided for generator along with thrust bearing housed in lower bracket. The Guide Bearing assy. shall have necessary instrumentations.

H.S. Lubrication System:

The H S Lub oil system shall be provided for the thrust bearing in order to create a positive oil film over the pads at low speeds during starting and stopping of the machine. The components consist of a positive displacement pump with its motor, filters, valves etc. mounted on a steel base. Associated piping and connection to Thrust Bearing shall be done at site.

Plug In Oil Coolers

The oil of the combined thrust cum lower guide bearing housing will be cooled by the plug-in-type oil coolers. The Coolers shall be mounted on the Bottom Bracket center and proper water pipe connections with valves, instruments etc. shall be made at site.

Ventilation

The generator shall have a closed-circuit air ventilation system. Air coolers shall be mounted on the stator frame help dissipate the heat from the stator core. Air guides and air baffles are provided to control the direction of the air-flow.

Brackets

Upper bracket:

The upper bracket consists of a fabricated steel structure having a central part and 8 nos. radial arms. The arms are to be bolted to the central part at site. It shall support the weights of the stationary parts of brush gear, generator covers, mechanical over speed device, creep detector, speed signaling generator (S.S.G) etc.

Lower bracket:

The lower bracket consists of a fabricated steel structure having a central part and 4 nos. radial arms. The arms are to be bolted to the central part at site. The guide bearing and thrust bearing shall be housed in it along with oil coolers. Brake-jack assembly shall be mounted on the bracket for rotor braking.

Braking and Jacking System

Pneumatic operated brake units shall be mounted on the bottom bracket that may also be used for jacking the rotor during assembly/maintenance. A complete hydraulic rotor jacking unit shall also be supplied. The brakes shall be operated using a control panel located outside the generator barrel. For trapping and subsequently disposing the dust generated during braking, brake dust collector system along with control panel shall also be supplied.

Over Speed Device

A mechanical over speed device shall be mounted on the top of the rotor. The plunger shall operate the Hydraulic slide valve and the spring operated latched switch mounted on bracket. The over speed device will be set to trip at a speed above the full load throw off speed of the unit.

CO_2 Type Fire Extinguishing System:

Carbon dioxide type fire extinguishing system for all four generators shall be provided. Smoke detectors are provided in all the generators with common control panel. Two CO_2 banks, each consisting of an adequate nos. of CO_2 cylinders will be provided, one acting as main and other as standby.

Other Major Equipment:

- Partial discharge analyzer
- Online vibration monitoring system
- Shaft current monitor
- Moisture detector

- Hydrostatic lubrication system
- Oil vapour piping system
- Generator flooring (segmental)
- Barrel Lighting
- Space heaters
- Pit access door
- Generator Instrumentation panels/ Generator marshaling Box.
- Metering & Gauge panel.

General Notes:

i. Special welding electrodes for main assemblies like Stay Ring, Runner envelop, Top Cover, Pivot Ring, DT Liners, DT Cones, Guide apparatus, major piping works of turbine eg: CW Systems, drainage/dewatering system etc. shall be provided by BHEL manufacturing units and shall be issued to contractor for subject work free of cost. Contractor shall maintain proper records for all those consumables. Any additional requirements resulting due to reasons namely but not Limited to avoidable wastages, mishandling, poor storage, high rate of rejections due to poor quality of welding or deployment of insufficiently experienced welders etc. shall be arranged by contractor at his own cost within their quoted price for subject work. In case the electrodes supplied issued by BHEL are found inadequate/unusable, contractor has to arrange the same from market as per provision SCC 4.1.5 and actual cost reimbursable basis. General purpose welding rods shall be arranged by contractor at his own cost.

ii. Insulating materials for stator winding & Rotor assembly shall be provided by BHEL.

iii. First filling of oil with 10% extra for turbine and generator bearings, OPU/ Governing system, and transformers shall be supplied by BHEL. Any undue wastage of oil due to mishandling, poor quality of piping and/or other works resulting into leakages or spillages shall have to be arranged by contractor at his cost or recoverable from him.

iv. NDT: NDT test of all weld joints shall be done in accordance to the drawings.

v. The equipment and piping shall be erected in conformity with the provision of standard/ specification and as may be directed by BHEL. The method of welding (Arc, gas, TIG or other method) may be indicated in the detailed drawing/ schedules. BHEL engineer will have option of changing the method of welding as per site requirements.

vi. The Turbine shall have concrete spiral casing. Casting of concrete Spiral casing shall be in Civil Agency scope.

vii. The information provided in above details of work is tentative. There may be chances of some changes during detailed engineering of the systems to suit the site requirement, for which no additional compensation will be payable and contractor shall complete the entire work as detailed in the tender specifications within finally accepted rates/ prices.

viii. Work of Fibre Optical Cable in Power House shall be in the scope of contractor.

ix. Construction drawings and documents shall be provided at site to the successful bidder for erection of work.

x. Erection of 1st stage embedded pipelines, 2nd stage embedded pipelines, oil & water or any other pipelines for all above systems including fabricating/making site bends, cleaning, Acid pickling & preservation, clamping, flushing, hydraulic testing as per drawing requirements and standard practices etc. Pipes shall in general be supplied in straight lengths and to be bent at site as per requirement. For medium and large size pipes, regular bends may not be supplied and therefore bends shall have to be fabricated at site. Pipe routing as shown in the drawing may have to be changed/modified to suit the site condition.

xi. The ends of the pipelines shall be kept covered during concreting and/or other civil works. Insulation of the pipelines as per requirements given in the relevant drawings/doc of different systems shall be done at site. Insulation material shall be provided by BHEL.

xii. Painting may also be required on embedded / foundation parts prior to concreting etc.

xiii. In order to maintain the time schedule, depending on site condition/ requirement the contractor shall be required to do stator core building and Stator winding in Generator pit. The contractor shall carry the work within finally accepted rates/ prices. Special Tools & tackles required for Stator Core Building & Winding shall be provided by BHEL.

xiv. Notwithstanding of the above, and scope of painting mentioned in Chapter 10, Part –II of TCC, SCC 6.2.2, final painting of the equipment after commissioning to be done

by contractor as per the instructions of BHEL engineer. Paints for final painting shall be supplied by BHEL.

xv. Some of the main tests apart from the routine tests during erection, pre commissioning and commissioning shall include Core Flux/ELCID test, HV test, bearing heat run, Over-speed test, SCC, OCC, load rejection tests in stages up to 110%, emergency stop tests, turbine & generator output tests, vibration measurement & balancing etc. on all the units and field efficiency test and type test on one unit. Inspection of the units shall be carried out after load throw off tests and re-tightening of wedges, fasteners etc. shall be carried out.

xvi. Any other works required to be carried out which have not been explicitly mentioned above but are essentially required to be carried out to complete the individual assemblies and the unit/ units as a whole including pre-commissioning and commissioning.

xvii. Details with Weight & Dimension of major equipment supplied by BHEL under this scope are given in **Chapter-IV, Part-I of TCC**. However, changes in design may occur as is usual in such large project, for which no additional compensation will be payable and contractor shall complete the entire work as detailed in the tender specifications within finally accepted rates/ prices.

xviii. In view of the tight erection schedule, limited area in service bay and stator/rotor assembly being in critical path, whatever pre-erection preparatory works can be carried out in BHEL store area shall have to be planned accordingly. In particular, the cleaning, de-burring, de-greasing and segregation of rim punching by weight may be planned and carried out in store area within the finally agreed price.

2.2. Within the finally agreed price, the contractor under this contract shall provide protocol services in Kinshasa, D R Congo (including vehicle & Interpreter services) for Immigration clearance and pick up from airport, drop at Hotel /Guest house in Kinshasa & pick up from Guest house/hotel and drop at airport, clearance for check in for going to further destination to Kananga/Delhi for visiting BHEL officers/ staff during transit. Total no. of visit shall be approx. 80 (2 x 40) visits during the contract period.

In case contractor fails to provide above services to BHEL, the later shall have the right to hire such services from other agencies at the risk and cost of the contractor. However, if BHEL does not utilize the no. of visits as per above provision, fully or partly,

recovery at the rate of USD 65/visit will be made from the final bill of the contractor. Additionally utilized service for Protocol shall be made with the same rate.

2.3. Within the finally agreed price, the contractor under this contract shall provide services of skilled and unskilled persons for a total period of 300 Man-months (MM) exclusively for use by BHEL. This manpower will be required for following services:

i. Qualified computer operator (knowledge of English is must) for office and stores work for 30 man-months for record keeping.
ii. Providing service of interpreter for 30 man-months. The interpreter should have proficiency of English, French and local languages.
iii. Two drivers for BHEL staff car for 60 man-months. The driver should have good driving skills and should have valid driving license.
iv. One Cook (specialist in cooking Indian food) and one helpers for cooking Indian food for BHEL staffs at site for 60 manmonths.
v. Unskilled workers for up-keeping of office, field hostel for 120 man-months.

Note:

a. In case contractor fails to provide above-mentioned manpower as desired by BHEL, the later shall have the right to hire such services from other agencies at the risk and cost of the contractor. However, if BHEL does not utilize the man-months as per above provision, fully or partly, recovery at the rate of the prevailing minimum wages in the country for the categories will be made from the final bill of the contractor.
b. Persons shall be deployed as per requirement and instruction of BHEL Engineer at site.
c. Persons so deployed shall have to work in extended hours whenever required. Workmen provided as per the above provisions shall be fully trained and experienced in the nature of work for which they are deployed.
d. Record of deployment shall be maintained by contractor and verified by BHEL engineer on regular basis.

2.4. Within the finally agreed price, the contractor under this contract shall provide fuel for BHEL staff cars @ 125 liters /vehicle month for 60 vehicle months. Monthly record shall be maintained and verified by BHEL Engineer at site.

In case of BHEL doesn't utilize in the quantity of fuel (partially or fully), the recovery shall be made as per prevailing rate at site as on the date of synchronization of last unit from final bill for unutilized quantities.

3. Time Schedule

3.1. Initial Mobilization

After receipt of LOA, Contractor shall discuss with Project Manager / Construction Manager of BHEL regarding initial mobilization for erection. Contractor shall start mobilization of necessary resources within 4 weeks of issue of letter of intent or as per the directive of Project Manager / Construction Manager. Such resources shall be progressively augmented to match the schedule of milestones and commissioning.

3.2. Mobilization for the scope of works incl. material handling and erection

The activities for material handling and erection shall be started as per directions of Construction Manager of BHEL. Contractor shall mobilize resources as per requirement to commence the work of material handling and erection and further augment for carrying out entire scope of works.

3.3. Commencement of Contract Period and Tentative Schedule

BHEL Engineer will certify the actual date of start of work (zero date) after following:

a) Adequate mobilization of manpower, T&P, other pre-requisites
b) Furnishing of security deposit by contractor as per Cl. 1.10 of GCC
c) After the contractor gets registered with the local authorities in D R Congo, if required.

Material has already been arriving at site and is being unloaded at BHEL stores. Material verification and storage shall be undertaken immediately by contractor, after their mobilization at site. Fronts for erection of 1st stage embedment incl. Draft Tube Liners/ pier nose liners assembly shall be available and contractor shall be required to start erection at available fronts immediately on their mobilization at site as per the directive of Project Manager/Construction Manager of BHEL.

The contractor has to subsequently augment his resources in such a manner that major milestones of erection, testing & commissioning shall be achieved as per tentative schedule in **Annexure- II**. Detail activity wise schedule will be discussed and finalized with successful bidder after their mobilization at site.

3.4. Contract Period

The contract period for completion (provisional acceptance) of entire works including material handling under the scope, erection, testing & commissioning and handing over of all units will be **30 (Thirty) Months** from the actual date of start (zero date).

3.5. Completion of Works

Once the commissioning is performed, the experimental operation/ reliability run for period of 30 days shall be conducted which will include 72 Hrs Trial Run. After successful completion of above and all other acceptance test including field efficiency test of turbine and generator as per drawings/docs to be conducted and also all pending/punch points to be attended, then contract shall be considered as "completed".

3.6. **Guarantee Period**

12 months Guarantee period shall be commenced from the date of completion of last unit of 4 x16 MW Grand Katende Hydro Power Project.

4. Tentative Weight Schedule

4.1. Detail package weight & dimension are as per **Annexure-I.** Total material to be handled and erected shall be approx. 4400 MT. Out of 4400 MT materials, about 40 % materials has already received at site and same has been unloaded by AIL and kept in BHEL's stores.

4.2. Weights and package size mentioned for the above items are tentative and may change during detail design. The contractor shall have execute the actual weight required for completion of the system in the finally agreed rate.

4.3. Number of Panels, size and weight for Control & Monitoring system, excitation system, protection system, starter panels, LTAC system, DC system, MVAC system etc. shown are tentative and likely to change during detail design. Complete scope of PSNR shall be the scope of Erection Contractor.

5. Rate Schedule

Contractor shall fully understand equipment description and Scope of Work including Notes, Inclusion and Exclusion before quoting. The scope of work and responsibility of the contractor as mentioned under these specifications shall be covered within the quoted rates.

The bidder has to quote his price keeping in mind the facilities and T&Ps to be given free of cost as specified in **Chapter-VIII & X of Part-I of TCC.**

Bidders shall quote Prices in **US dollars** for all the items and bids shall be evaluated accordingly.

Since the job shall be executed at site, bidders may visit site/ work area and study the job content, facilities available, availability of materials, prevailing site conditions including law & order situation, applicable wage structure, wage rules, etc. before quoting for this tender.

The tenderer shall quote lumpsum price for total scope of works under this tender in Part I: Rate Schedule only. No cutting/ erasing / over writing shall be done.

The lumpsum price quoted in the Part I: Rate Schedule shall be broken up and allocated against different items in the Part-II: Rate Schedule.

Part I: Rate Schedule	
Description of work	**Total Price in US Dollar (A)**
Total Price (**A**) in US Dollar (In figures and words) for Material handling, Erection, Testing, Commissioning, Trial operations & handing over of E&M packages incl. Kaplan turbines, Generators and its auxiliaries, Excitation Systems, Generator Transformers, C&I, EOT Crane, Fire Fighting System, VAC system etc. and providing other miscellaneous services for 4x16 MW Grand Katende HEP, D R Congo	

Note:

1. Evaluation of bids shall be done on total price (**'A'**) against the above Rate Schedule only.

2. In case of any mismatch in Rate and amount on Price discrepancy, the same will be dealt as per clause No. 1.4 of GCC.

Part II : Rate Schedule					
Item No.	**Brief description of work**	**Unit**	**qty.**	**Unit Rate, in USD**	**Price in USD**
1	**E, T & C works**				
1 (a)	Erection, testing, commissioning, trial operations & handing over of vertical Kaplan Turbines, Generators, Transformers, Excitation systems and their auxiliaries etc. of 4 x 16 MW HYDRO UNITS OF GRAND KATENDE HEP as per the tender specifications.	**One set**	**Lumpsum**	**Not Applicable**	(88 % of **A)**
2	**Material handling works**				
2 (a)	Verification, proper storage, re-stacking and preservation of materials / equipment unloaded by other agency in project stores / power house/ work site(s).	Tonne	4400	(5% of **A**) 4400	(5 % of **A)**

2 (b)	Loading of materials / equipment from project stores with mobile crane on truck/trailer and transportation to & unloading at power house or work site(s) for erection with EOT crane or mobile crane/ alternate method.	Tonne	4400	(7% of **A**) 4400	(7 % of **A)**

Note:

1. In case of Price Discrepancy, GCC Cl. 1.4 shall be referred.
2. For Item No. 1 (a) lump sum price is to be quoted and it will not change in case of quantities variation.
3. However, the quantities indicated against Item No. 2 (a) & 2 (b) above are tentative and are liable to vary depending upon the site requirement. The contractor has to handle/provide services for the actual quantities as per advice of BHEL Engineer. The final contract price shall be adjusted on the basis of quantities actually to be handled at site & payment will also be regulated for the same as per clause GCC 2.14. The contractor confirms that total price quoted above takes care of such variations during execution stage.

6. Terms of Payment & BBU

6.1. Terms of Payment

A. Payment of Final agreed amount shall be in USD through SWIFT from our Foreign Currency account maintained in India. Bank Charges and/or conversion charges upto payee account will be borne by contractor.

B. All payment shall be released subject to Reserve Bank of India guidelines.

C. Retention amount shall be withheld from each RA bill as per provision of clause 2.22 of GCC.

D. Subject to any deduction which BHEL may be authorized to make under the contract, the contractor on the certificate of the Engineer at site is entitled for payment as explained hereunder-

TERMS OF PAYMENT – GRAND KATENDE HEPP		
Item No.	**Brief Description of Work**	**Unit**
1	**E, T & C works**	
1 (a)	Erection, testing, commissioning, trial operations & handing over of vertical Kaplan Turbines, Generators, Transformers, Excitation systems and their auxiliaries etc. of 4 x 16 MW HYDRO UNITS OF GRAND KATENDE HEP as per the tender specifications.	On completion of activity based on Billing Break Up (**as per Clause 6.2 below**) for contract value of Erection, Testing & Commissioning works.
2	**Material handling works**	
2 (a)	Verification, proper storage, re-stacking and preservation of materials / equipment unloaded/to be unloaded by other contractor in project stores / power house/ work site(s).	60% of unit rate on verification and preparation of verification & material discrepancy reports and Record keeping (Maintaining DB Register, Stock Register, Material Issue register). i) For the materials already unloaded at site stores (before date of site mobilization), verification of these materials has to be completed within 06

		months from date of site mobilization. Sequence for verification of packages shall be decided by BHEL Engineer as per site requirement, failure of which 5% out of 60% shall be forfeited as certified by Engineer. ii) Material verification has to be completed within 01 month on receipt (unloading) of material in stores, failure of which 5% out of 60% shall be forfeited as certified by BHEL Engineer AND 40% of unit rate after re-stacking/packing and preservation on priority decided by Engineer.
2 (b)	Loading of materials / equipment from project stores with mobile crane on truck/trailer and transportation to & unloading at power house or work site(s) for erection with EOT crane or mobile crane/ alternate method.	100% of unit rate after safe receipt/unloading of material at PH/work site and based on tonnage handled.

6.2. **Billing Break Up (BBU)**

BILLING BREAK UP 4X16 MW GRAND KATENDE HEP, D R CONGO							
SNO	**ACTIVITY**	**UNIT NO**				**Common System**	**TOTAL (% of E,T&C contract value as in rate schedule item)**
		I	**II**	**III**	**IV**		
A	**TURBINE**						
1	Erection of Pipes & Embedments in 1st stage & Embedded tubes for field efficiency testing upto EL 627.6	0.25	0.25	0.25	0.25		1.00
2	Erection of balance Pipes & Embedments in 1st stage & Embedded tubes for field efficiency testing	0.25	0.25	0.25	0.25		1.00
3	Installation of Draft tube liners, Welding, NDT and handing over for concreting.	1.00	1.00	1.00	1.00		4.00
4	Installation of Pier Nose Liners	0.60	0.60	0.60	0.60		2.40
5	Installation of runner envelope	0.25	0.25	0.25	0.25		1.00
6	Installation of stay ring and handing over for concreting	0.75	0.75	0.75	0.75		3.00
7	Installation of pit liners	0.50	0.50	0.50	0.50		2.00
8	Erection of Embedments & Pipes in 2nd stage	0.30	0.30	0.30	0.30		1.20
9	Runner Assembly and testing in service	0.60	0.60	0.60	0.60		2.40
10	Lowering of Runner-shaft assembly in pit	0.15	0.15	0.15	0.15		0.60
11	Installation of guide apparatus assembly.	0.75	0.75	0.75	0.75		3.00
12	Guide bearing and shaft seal assy	0.25	0.25	0.25	0.25		1.00

13	Erection of OPU (Turbine), pressure accumulator, HMC, OLU and oil piping.	0.20	0.20	0.20	0.20		0.80
14	Completion of piping & Instrumentation in Turbine Pit	0.15	0.15	0.15	0.15		0.60
15	Installation of Oil Header & oil tube assembly	0.30	0.30	0.30	0.30		1.20
	Sub Total						**25.20**
B	**GENERATOR**						
1	Assembly of stator frame segments and readiness for core assembly in service bay	0.20	0.20	0.20	0.20		0.80
2	Stator core building upto 50% height	0.30	0.30	0.30	0.30		1.20
3	Stator core building upto full height and final pressing.	0.25	0.25	0.25	0.25		1.00
4	Conducting Core Flux Test/ ELCID test of Stator core.	0.25	0.25	0.25	0.25		1.00
5	Laying of Lower bars of Stator winding	0.20	0.20	0.20	0.20		0.80
6	Laying of upper bars of Stator winding	0.20	0.20	0.20	0.20		0.80
7	Completion of slot wedging and HV test of upper bars.	0.30	0.30	0.30	0.30		1.20
8	Completion of Brazing & Final HV test of Stator Winding in S/B.	0.75	0.75	0.75	0.75		3.00
9	Dressing of stator foundation, alignment and centring of Stator Sole plates	0.20	0.20	0.20	0.20		0.80
10	Lowering of Wound Stator assembly in pit	0.30	0.30	0.30	0.30		1.20
11	Assembly of Rotor spider segments and levelling of Bottom plates for core building in S/B.	0.20	0.20	0.20	0.20		0.80

12	Assembly of rotor rim including final pressing	0.40	0.40	0.40	0.40		1.60
13	Balance assy of rotor ,poles, connections, CC leads, including HV testing	0.30	0.30	0.30	0.30		1.20
14	Erection of lower bracket, thrust brg, brake jacks	0.30	0.30	0.30	0.30		1.20
15	Lowering of rotor in pit	0.25	0.25	0.25	0.25		1.00
16	Assy top brkt in service bay, its lowering in position, centring, levelling	0.25	0.25	0.25	0.25		1.00
17	Installation of Brush-Gear and collector assembly	0.10	0.10	0.10	0.10		0.40
18	Installation of Air coolers & Oil coolers and completion cooling water piping in Generator Pit	0.20	0.20	0.20	0.20		0.80
19	Generator Fire Fighting system (CO2)	0.10	0.10	0.10	0.10		0.40
	Sub Total						**20.20**
C	**ELECTRICAL SYSTEMS**						
1	Placement of 3 phase GSU Transformers on its foundation.	0.50	0.50	0.50	0.50		2.00
2	Installation of Radiator banks, conservators and instrumentations of GSU Transformer	0.25	0.25	0.25	0.25		1.00
3	Creating vacuum and oil filtration/ filling in GT and readiness of instrumentation and charging	0.50	0.50	0.50	0.50		2.00
4	Installation of Excitation & Unit Auxiliary Transformers	0.50	0.50	0.50	0.50		2.00
5	Installation of SP Bus Cables incl. CTs, VTs, LAVT, NG cubicles.	1.25	1.25	1.25	1.25		5.00

6	Installation of Voltage Regulation & Excitation System.	0.50	0.50	0.50	0.50		2.00
7	Installation of Station, Station Service Transformers					1.50	1.50
8	Installation of cable trays (for power & Control cables)	0.30	0.30	0.30	0.30	0.30	1.50
9	Laying, dressing, Glanding and Termination of Power Cables	0.60	0.60	0.60	0.60	0.30	2.70
10	Laying and dressing of control & instrumentation cables.	0.85	0.85	0.85	0.85	0.40	3.80
11	Completion of Dressing, ferruling, loop testing and termination of control cables.	0.60	0.60	0.60	0.60	0.40	2.80
	Sub Total						**26.30**
D	**COMMON SYSTEMS**						
1	Installation & commissioning of 110/10 T EOT crane incl load testing					2.00	2.00
2	Installation of equipment of Mechanical Workshop including EOT					0.40	0.40
3	Installation and commissioning of DG Sets					1.00	1.00
4	Erection of Unit HP compressed air system including piping					0.15	0.15
5	Erection of Unit LP compressed air system including piping					0.15	0.15
6	Installation of Cooling water system including piping	0.50	0.50	0.50	0.50		2.00
7	Installation of Drainage and Dewatering System including piping					0.20	0.20

8	Installation of DC system (Battery Bank, DCDB/ACDB, Battery chargers, Inverter panels etc.)					0.30	0.30
9	LTAC/ AC Auxiliaries system					0.50	0.50
10	Inst. of Fire Detection & Fire Fighting System for PH different floors, transformers, switchyard					1.30	1.30
11	Installation of Ventilation system & Air Conditioning System					1.30	1.30
12	Installation of Elevator					0.60	0.60
13	Inst. & commg of Lubricating Oil & Insulation Oil filtration system					0.10	0.10
14	Installation of SCADA, Control & Monitoring panels	0.20	0.20	0.20	0.20	0.10	0.90
15	11 kV Switchgear with accessories					0.60	0.60
16	Protection system for gen and transformers with wiring & cubicles	0.15	0.15	0.15	0.15		0.60
17	Installation Telephone/ Communication System					0.10	0.10
	Sub Total						**12.20**
E	**UNIT ALIGNMENT & BOXING UP,**						
1	Turbine- shaft coupling and Combined Unit Axis Alignment	0.50	0.50	0.50	0.50		2.00
2	Completion of Magnetic axis & air gap setting and Installation of Air Guides	0.25	0.25	0.25	0.25		1.00
3	Box up of turbine	0.60	0.60	0.60	0.60		2.40
4	Box up of generator	0.90	0.90	0.90	0.90		3.60
	Sub Total						**9.00**

F	**UNIT SPINNING, TESTING, COMMISSIONING**						
1	Testing of unit controls and auxiliary panels	0.50	0.50	0.50	0.50		2.00
2	Spinning of unit.	0.25	0.25	0.25	0.25		1.00
3	Synchronisation of unit & Load Throw off	0.20	0.20	0.20	0.20		0.80
4	Reliability run of 30 days incl. 72 hrs trail run	0.30	0.30	0.30	0.30		1.20
5	Final Painting	0.15	0.15	0.15	0.15	0.10	0.70
6	Resolution of pending/ points	0.30	0.30	0.30	0.30		1.20
7	Field Efficiency Testing of Generating Unit					0.20	0.20
	Sub Total						**7.10**
				TOTAL			**100.00**

Note:

1. In order to facilitate part payment, BHEL Site Engineer at his discretion may further split the contracted rates/percentages to suit site conditions, cash flow requirements according to the progress of work as per GCC Cl. 2.23.1 v).

2. The above billing break up may not include all the activities and packages for Erection, testing & commissioning of E&M package under scope of contract. However, erection, testing & commissioning of all the equipment and other services in the scope of contract will be in within the quoted price.

3. Contractor shall submit bills for the work completed under the specification as per the Billing Break Up above, once in a month detailing work done during the month. The format for billing shall be approved by BHEL before raising invoices.

7. Taxes and Other Duties

7.1. Project is being financed by Government D R Congo and EXIM Bank of India, is exempted from taxes, customs duties, fees and any other fiscal charges of any nature whatsoever that may be demanded by the Public Authorities of the Democratic Republic of Congo while execution of the Contract, both with regard to the Equipment and Supplies and the services including those of foreign staff, and this, in accordance with the laws and regulations in force in D R Congo.

7.2. In case where the Public Authorities would not grant exemption from these expenses, it would be borne by the contractor and BHEL shall got the same reimbursed from customer against submission of supporting documents.

7.3. All duties and taxes whatsoever, as well as customs fees and process costs, the necessary documents for import or re-export, etc. other than those that may be imposed by the Public Authorities of the Democratic Republic of Congo, are borne by the Contractor.

7.4. Prices of the Bidding shall be taken into account all taxes, duties and fees payable outside D R Congo, on the materials, workmen, tools, equipment and generally on all foreign goods. No variance or changes in taxes outside D R Congo will be reimbursed.

7.5. Bidders shall quote their Prices inclusive of all applicable taxes and duties. No taxes/ duties or any other levies other than mentioned above shall be exempted/paid/ reimbursed separately.

7.6. TDS under income Tax, sales tax, VAT and surcharge or any other taxes etc, if any, as per Indian/ D R Congo Law, as applicable, shall be deducted at the prevailing rate on gross invoice value from the running bills unless exemption certificate from appropriate Authority / Authorities is furnished.

7.7. Contractor shall get his organization registered with concerned statutory /local sales tax authorities, if required (as per the requirement in D R Congo), within 30 days/as per law of D R Congo of award of the contract as per requirements. The delay on this account and delay in bringing the material shall be to contractor's account and no extension of time shall be allowed on this account. The sales tax registration for this contract shall be forwarded to BHEL within 45 days from the date of LOA. In case the contractor is already registered for sales tax with Govt. Authorities, he must quote his registration number while submitting the tender.

7.8. Contractor has to make his own arrangement at his cost for completing the formalities (Including Work Permits/Road Permits), if required, with the concerned Authorities in D R Congo, for bringing his materials, workmen, tools & plants, equipment at site for the execution of the work under this contract.

8. Facilities in the scope of Contractor/BHEL

Sl.No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.1.0	**ESTABLISHMENT**			
1.1.1	**FOR CONSTRUCTION PURPOSE:**			
A	Space for BHEL stores (open, semi closed and closed store)	Yes		4000 sq.m open store, 400 sq.m semi closed store & 600 sq.m closed store has been constructed and given by AIL at a distance of approx. 500 m from power house.
B	Facilities in closed storage shed for storage & preservation of materials.		Yes	To be done as per Cl 5, Part –II of TCC
C	Space for bidders stores, canteen and office.	Yes		Shall be given free of cost in the campus.
C.1	Construction of bidder's office, canteen and bidder storage building including supply of materials and other services.		Yes	
C.2	Bidder's all office equipment, office / store / canteen consumables.		Yes	
C.3	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
C.4	Fire fighting equipments like buckets, extinguishers etc.		Yes	
C.5	Fencing of bidder storage area, office, canteen etc.		Yes	
1.1.2	**FOR LIVING PURPOSES OF THE BIDDER**			

Sl.No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
A	Area for labour colony	Yes		Constructed labour colony to accommodate around 75 labours (Dormatory arrangement) with RO drinking water & power shall be provided by AIL in a phased manner as per requirement free of cost.
B	Living accommodation		Yes	Excluding above, in 1.1.2 A, all faclilties shall be developed by the bidder.
1.2.0	**ELECTRICITY**			
1.2.1	**Electricity For construction purposes**			
1.2.1.1	Single point source	Yes		Construction power of 250 kVA at single point in S/B shall be provided by AIL for erection purpose, free of cost.
1.2.1.2	Consumption charges for construction Power.	Yes		Construction power shall be provided free of cost.
1.2.1.3	Further distribution for the work to be done which include supply of materials and execution.		Yes	Further distribution upto equipments /wok area to be done by the contractor.

Sl.No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.2.1.4	Maintenance of lighting, distribution boards at suitable working area.		Yes	
1.2.1.5	Providing of the consumables such as sockets, switches, MCCB, bulbs etc.		Yes	
1.2.2	**Electricity for BHEL's stores**			
1.2.2.1	Single point sources	Yes		
1.2.2.2	Distribution from single point including supply of materials and service.		Yes	
1.2.2.3	Supply, installation and connection of material of energy meter, if required including operation and maintenance.	Yes		Refer 1.2.1.3 above
1.2.2.4	Payment of electricity consumption			Not Applicable
1.2.2.5	Duties and deposits including statutory clearances for the above.			Not Applicable
1.2.2.6	Living facilities for office use including charges.		Yes	
1.2.2.7	Maintenance of lighting, distribution boards at suitable working area.		Yes	
1.2.2.8	Providing of the consumables such as sockets, switches, MCCB, bulbs etc.		Yes	
1.2.2.9	Demobilization of the facilities after completion of works.		Yes	
1.2.3	**Electricity for the bidder office, stores, canteen etc. which include:**			
1.2.3.1	Single point sources	Yes		
1.2.3.2	Distribution from single point including supply of materials and service		Yes	
1.2.3.3	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	

Sl.No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.2.3.4	Duties and deposits including statutory clearances for the above			Not applicable
1.2.3.5	Payment of electricity consumption, if any			Not applicable**.**
1.2.3.6	Demobilization of the facilities after completion of works		Yes	
1.2.4	**Electricity for living accommodation of the bidder's staff, engineers, supervisors etc. on the above lines**			
1.2.4.1	Single point sources	**Yes**		
1.2.4.2	Distribution from single point including supply of materials and service		Yes	
1.2.4.3	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	
1.2.4.4	Duties and deposits including statutory clearances for the above			**Not applicable.**
1.2.4.5	Payment of electricity consumption, if any			Not applicable**.**
1.2.4.6	Demobilization of the facilities after completion of works		Yes	
1.3.0	**WATER SUPPLY**			
1.3.1	**For construction purposes:**			
1.3.1.1	Making the water available at single point.	Yes		AIL/BHEL to provided construction water free of cost
1.3.1.2	Further distribution as per the requirement of work including supply of materials and execution.		Yes	
1.3.2	**Water supply for bidder's office, stores, canteen etc**			

Sl.No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.3.2.1	Making the water available at single point.	Yes		
1.3.2.2	Further distribution as per the requirement of work including supply of materials and execution.		Yes	
1.3.3	**Water supply for BHEL stores**			
1.3.3.1	Making the water available at single point	Yes		
1.3.3.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.4.0	**LIGHTING**			
1.4.1	For construction work (supply of all the necessary materials) 1. At the preassembly area 2. At the construction site /work area.		Yes	
1.4.2	For construction work (execution of the lighting work/ arrangements) 1. At the preassembly area 2. At the construction site /work area.		Yes	
1.4.3	Maintenance of Lighting materials such as lamps, extension boards, hand lamps, cables etc. for stores (open and closed)		Yes	
1.4.4	Providing the necessary consumables like bulbs, switches, etc during the course of construction.		Yes	
1.4.5	Lighting for the living purposes of the bidder at the colony / quarters for his use.		Yes	
1.5.0	**Communication Facilities for Site Operations of the Bidder**			

Sl.No	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
1.5.1	Telephone, fax, internet, intranet, e-mail etc.		Yes	
1.6.0	**Compressed Air Supply**			
1.6.1	Supply of Compressor and all other equipments required for compressor and compressed air system including pipes, valves, storage systems etc.		Yes	
1.6.2	Installation of the above system and operation and maintenance of the same.		Yes	
1.6.3	Supply of the all the consumables for the above system during the contract period.		Yes	

Sl.No	Description PART II ERECTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
2.1.0	Engineering works for construction:	BHEL		
2.1.1	Providing the erection drawings for all the equipments covered under this scope.	Yes		
2.1.2	Drawings for construction methods.	Yes		
2.1.3	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes	Yes	Yes	Bidder shall provide support to BHEL in making as built drawings.
2.1.4	Shipping lists etc for reference and planning the activities.	Yes		
2.1.5	Preparation of site erection schedules and other input requirements.	Yes	Yes	To be jointly done on regular basis.

Sl.No	Description PART II ERECTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
2.1.6	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments.	Yes	Yes	To be jointly done on regular basis.
2.1.7	Weekly erection schedules based on Sl No 2.1.5		Yes	To be jointly done on regular basis.
2.1.8	Daily erection / work plan based on Sl No 2.1.7		Yes	To be prepared by bidder in consultation with BHEL.
2.1.9	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two months.		Yes	
2.1.10	Preparation of preassembly bay.		Yes	

Note:

1. BHEL/ AIL shall make available limited open space for contractor's store free of rental charge. It is the responsibility of the contractor to construct temporary sheds for his use and to dismantle and clear the site after completion of work or as and when required, as a part of his scope of work.

2. Dormitory type accommodation for about 75 labourer with water & power shall be provided by BHEL/AIL in a phased manner as per requirement in project campus around 1 km from powerhouse, free of cost. Additional requirement of accommodation shall have to be arranged by contractor on their own cost.

3. Contractor shall be responsible for providing all other necessary facilities to staff and workmen not limited to water inside the rooms, proper sanitation, transport, medical facilities etc. at his own cost as required under various labour laws and statutory rules and regulations.

4. Construction Power of 250 kVA during erection shall be provided free of cost. Contractor at his cost shall do further distribution. Commissioning of 500 kVA DG set supplied in the package shall be in the bidder's scope. The bidder shall have to arrange fuel, lubricants & consumables for the DG set for within the finally accepted/contract price.

5. AIL/BHEL will provide construction water, potable water free of cost. Contractor shall lay network of pipelines at his cost to various work spots requiring construction water.

6. Provision of distribution lines of electrical power from the central points to the required place with proper distribution boards observing the applicable safety rules, shall be done by the contractor, supplying all the materials like cables, distribution board, switch boards, TPN, CBS, ELCBS/ MCCBS/ Copper/ Brass clamps, copper conductor, change over switches pipes etc. at his own cost. The contractor shall adjust his working shifts / hours accordingly and deploy additional manpower if necessary so as to achieve the targets.

7. General lighting of powerhouse, switchyard and other work area during erection, testing and commissioning shall be provided by AIL free of cost. Additional lighting arrangement such as flood lights, hand lamps and area lighting shall be arranged by the contractor at the site of erection, storage area etc. within finally accepted rates.

8. On completion of work or as and when required by BHEL, all the temporary buildings, structures, pipe lines, cables etc. shall be dismantled and leveled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so, the Engineer will be done it and expenses incurred shall be recovered from the contractor along with prevailing overhead. The decision of BHEL Engineer in this regard shall be final.

9. T&Ps and MMEs to be deployed by Contractor:

9.1. Indicative List of IMTEs to be arranged by the Contractor at his own cost

S. No.	Item	Qty.(Nos.)	Remarks
1.	Analog Multimeter voltage AC/DC 2.5-2500Vcurrent AC /DC-100Ma to 10A, Resistance upto 200 Mohm	03 Nos.	As Per Requirement (APR)
2.	Digital Multimeter 3 1/2 digit or higher (at least 3 of Fluke make)	06 Nos.	APR
3.	Meggar hand operated/motorized 500V / 1000V	01 No.	APR
4.	Meggar motorized 5000V	02 Nos.	APR
5.	Phase sequence indicator 110-450V	02 Nos.	APR
6.	Frequency meter 0-100 HZ (0-110-230-415 V)	01 No.	APR
7.	Clamp meter (mA range for spill current measurement)	02 Nos.	APR
8.	Clamp meter for current measurement (1000A range)	02 Nos.	APR
9.	Single phase variac 0-220 V,15A	01 No.	APR
10.	Three phase variac 0-415 ,25A	02 Nos.	APR
11.	Rheostat 0-250 ohms 2A, 0-8 Ohms 15A, 0-26 Ohms 5A, 0-165 ohms 2 Amps	03 each	APR
12.	Optical portable tachometer(Digital) 0-5000 r.p.m. or higher	01 No.	APR
13.	Digital micro Ohm meter (10 A range)	01 No.	APR
14.	A.C. H.V. Test Kit (40kV,2A)	01 No.	APR
15.	Dead weight Tester for calibration of pressure gauge.	01 No.	APR
16.	Stop watch	02 Nos.	APR
17.	Precision Thermometer (0-100 deg C)	02 Nos.	APR

18.	Sound level meter 150 db.	01 No.	APR
19.	Primary injection kit (1500 Amp)	01 set	APR
20.	Digital Handheld Temperature meter	01 No.	APR
21.	Loop tester(Continuity tester)	06 Nos.	APR
22.	Walkie Talkie sets (with License)	03 sets	APR
23.	Field calibrator (Fluke make)	01 No.	APR
24.	Portable vibration meter (displacement and velocity, 2 channels)	01 No.	APR
25.	Elcometer	01 No.	APR
26.	BDV (Break Down Voltage) Kit	01 No.	APR
27.	PPM measuring Kit (water in insulating oil)	01 No.	APR

Note:

1. The above list specifies only major IMTEs to be deployed by the contractor. All additional IMTEs (other than as listed under Chapter -X) required for erection, testing and commissioning for timely and satisfactory completion of the facility shall also be deployed by the contractor within the finally accepted rates/ contract prices. Requirement of IMTEs shall be informed to contractor by Engineer-in-charge of BHEL, during execution of the project.
2. Duration and time of mobilization shall be decided by BHEL Engineer as per requirement (APR) at site and contractor shall mobilize it accordingly.
3. Other terms and conditions regarding above shall be as per the special condition of the contract clause no. SCC 4.2.1 (Tools & Plants, IMTEs).

9.2. **Indicative List of Tools and Plants for Material Handling & Erection, Testing & Commissioning to be arranged by the contractor at his own cost:**

S. No.	Item/Description	QTY (Nos.)	Remarks
1.	Truck/trailer of suitable capacity	1 No.	Suitable arrangement to be made for ODC when required.
2.	Hydra Crane – Not less than 10 MT capacity	1 No.	
3.	Mobile Crane – of suitable capacity (for handling of supplied ODCs)	As per requirement	Suitable for ODCs
4.	Fork lift – 3 T	1	
5.	Fire extinguishers 10 Kg A,B,C & dry powder type	Minimum 15 Nos.	
6.	General purpose material handling T&P	As Per Requirement	
7.	Torque Wrenches up to 2000 NM	1 set	
8.	Impact Wrench (Pneumatic) up to 2400 NM	1 set	
9.	Chain pulley block of various capacities (2T, 5T, 10T), Pull lift	Min.2 Nos. each or as required	
10.	Lathe/Turning Machine	1 no.	Of suitable size/ capacity
11.	Pedestal Drilling Machine	1 no.	With suitable attachments & drill bits upto 36 mm.
12.	Pipe Bending Machine	01 or as required	
13.	Turn Buckle (2 T, 5 T, 10T etc)	APR	
14.	Hydraulic / Mechanical Jacks of various capacities (5-10-20-50 T)	APR	

15.	Gas cutting set (Acetylenes Cylinder, Oxygen Cylinder cutting set with hose & regulator.	As Per Requirement	Due to difficult in arranging Consumables like Gases, the bidder shall have make alternate arrangement like Plasma Cutting machine etc.
16.	Air Arc Gouging Arrangement	1 No.	
17.	Electrode Oven	APR	
18.	Pneumatic Straight Grinders	APR	
19.	Pneumatic Angle Grinders	APR	
20.	Hydraulic Test Pump (suitable for upto 100 kg/cm2) with pressure gauge	1 No./APR	
21.	Air Compressor.	APR	
22.	Hydraulic Jacks 50 Tons	4 Nos.	
23.	Welding machine set.	4 set	
24.	TIG Welding machine set.	2 set	
25.	Portable Plasma cutting machine	2 set	
26.	Hydraulic Crimping tool (upto 300 & 630 mm2 cable)	1 set each	
27.	Recti former/ heating arrangement for stator/ rotor assembly	As Required	As Per Requirement
28.	Ferrule printing machine	APR	APR
29.	Magnetic Drill machine	As per requirement	With suitable attachments &

			drill bits upto 24 mm.
30.	Precision tools (IMTE) TENTATIVE QUANTITY 1. 0.02 accuracy block level-2 nos 2. Dumpy level with accessories- 1 no 3. Theodolite/work station-01 no 4. Inside micrometer – as per requirement 5. Outside micrometer-0-25, 25/50, 50-75, 75-100, 100-150 6. Vernier callippers150, 300 – 2 each 7. Telescopic gauge- 2 sets 8. Slip gauge- 1 set 9. Feeler gauges- as per requirement 10. Dial gauge with magnetic stand-12 no 11. Depth gauge- as per requirement 12. Vernier caliper- as per requirement 13. Knife edge 14. Straight edge	As Per Requirement	As Per Requirement (APR)

Note:

1. The above list specifies only major T & P (may not be complete in items or numbers) to be deployed by the contractor. All additional / other tools and plants required for erection, Testing & commissioning for timely and satisfactory completion of the project/facility shall also be deployed by the contractor within the finally accepted rates/ contract prices.
2. Consignments which cannot be handled by above cranes of contractor/BHEL, has to be unloaded / handled by sleeper jack method. Alternatively suitable capacity crane is to be arranged by contractor for handling such consignments. The bidders are required to take note of it while submitting their offer.

3. In View of existing transportation infrastructure in the country, the bidder shall have to maintain the buffer stock of all consumables and mandatory spares for repair of T&Ps in sufficient quantity, at site. The contractor has to make provisions of above within the finally agreed price of the contract.
4. Other terms and conditions regarding above shall be as per the special condition of the contract clause no. SCC 4.2.1 (Tools & Plants, IMTEs).

10. T&Ps and MMEs to be deployed by BHEL on sharing basis

Sl. No.	Equipments	Capacity	Quantity
1.	EOT crane for PH	110/10 T	01
2.	Core Flux/ELCID test equipment	As per drg	01

Note:

1. Erection of the EOT crane shall be contractor's scope. The EOT cranes shall be provided free of hire charges and on sharing basis. Routine and regular maintenance shall be in the scope of the contractor for the period of crane being used for their scope of erection works. The said contractor shall also deploy the requisite number of crane operators (two or three nos. operator simultaneously) as per the instructions of BHEL engineer for operation of the crane for his scope of work in connection with Electromechanical works of BHEL. The crane operator may have to work in overtime also depending upon the work conditions for which no extra charge shall be payable to the contractor. The contractor will also provide the EOT crane services (including the operators) to the other contractors working in the powerhouse for civil and mechanical works if required. However, contractor will not be entitled for any compensation due to non-availability of EOT crane.

11. Any Other Requirement

11.1. Price shall remain firm throughout the contract period, including extended period, if any.

11.2. In case the contractor opts to furnish Bank Guarantee (BG) as a part of Security Deposit, the BG shall be issued preferably through any of the Schedule Bank in India. The BG may also be accepted from Foreign Bank at the sole discretion of BHEL, provided the BG is duly endorsed by any of the Indian Schedule banks.

11.3. The contractor in the event of execution of works, shall adhere to the law and the local provisions regarding the license to carry out an industrial activity, the conditions for employment of national and expatriate staff, import license for equipments and materials, use of radio-telephone, etc. The Contractor will fulfill the obligations arising, even indirectly, from the decisions or orders of the Public Authorities and regulations established by the Client. The provisions regarding safety of the labor, policy of hazardous, unhealthy or inconvenient establishments and hygiene of workers as per local laws are also to be adhered to during execution of the project.

11.4. Deductible franchises shall be 10% of claim amount subject to minimum USD 20, 000 in EAR Insurance policy which has been arranged by BHEL for insuring the materials/properties of BHEL/customer covering the risks during transit, storage, erection and commissioning.

11.5. Contractor has to fulfill quality requirement as per Chapter-VIII of Special Condition of Contract (SCC). In case of any gap in fulfilling these requirements by the contractor, financial penalty shall be imposed on the contractor with the rate mentioned in the "MEMO for penalty imposition against non-compliance in Quality area" enclosed as **Annexure-IV.** Penalty may also be accepted in equivalent USD with exchange rate as on the date of imposition of penalty (as per SBI rate on web page).

Rev 01
1st June,
2012

TECHNICAL CONDITIONS OF CONTRACT (TCC) PART-II

(Document No PS:MSX:TCC)

BHARAT HEAVY ELECTRICALS LIMITED

TECHNICAL CONDITIONS OF CONTRACT (TCC)
CONTENTS

1 General

BHEL has been awarded the work of design, manufacture, supply, Erection, Testing & Commissioning of the E&M Packages of 4x16 MW GRAND KATENDE HYDROPOWER PROJECT located in D R CONGO. The equipment under E&M Packages will as per List given in Cl. 2.1, Chpater-II, Part-I of TCC.

Followings are general scope works under this contract:

A. Reporting damages, providing necessary assistance for insurance claim lodging/settlement.

B. Material verification, shortage reporting and record keeping of unloaded/received materials at project store(s), proper re-stacking/handling in storage and preservations of consignments as per instructions.

C. Loading, Transportation of materials from the project store(s) to the powerhouse service bay/ work-front in project area and unloading of the same, for erection/installation.

D. Pre-erection assembly, erection, testing (including hydraulic test, NDT, electrical test, stage & final HV including dry out, core flux/ELCID test of generator etc. of relevant equipment at various stages during erection, pre-commissioning and commissioning, reliability run including trial run and handing over of four units of 4x16 MW Grand Katende Hydropower Project to customer.

E. Handing over of all supplied spares, Tools & Tackles to customer at their stores.

F. The scope of material handling also includes supervision of safe unloading of material in stores by AIL.

G. Handling and Transportation of scrap from powerhouse/ service bay/the pre-assembly area to Customer stores / scrap yard as per the instructions of BHEL engineer.

H. Providing sufficient illumination, firefighting equipment, warning signs, barricading in and around the place of work.

I. Providing services of skilled/semiskilled/unskilled persons for a total period of 300 Man-months (MM) including interpreter, car drivers, Indian cook, helper etc. exclusively for BHEL office and Field hostel.

J. Providing protocol Services (including vehicle & Interpreter services) for Immigration clearance, pick up and drop at air-port and Hotel/Guest House at Kinshasa for visiting BHEL officers/ staff during transit.

K. Providing fuel for cars for BHEL use.

L. Providing necessary support/assistance to BHEL/vendor commissioning engineer for system under this scope.

M. Providing assistance during field efficiency test of Generator & Turbine.

N. Handing over of all the spares to customer at their stores.

O. Handling and Transportation of scrap (packing wood and steel) from power house to Customer/BHEL stores / scrap yard as per the instructions of BHEL engineer.

P. Re-conciliation of materials with BHEL and Customer.

Q. Documentation and records (Films/ Movies/ Photographs) from embedment to evacuation of power. Submission of weekly progress report along with photographs.

R. The contractor shall carry out the work in accordance with standard practices/ codes/ instructions/ drawings/ documents/ specification supplied by BHEL/Customer from time to time.

1.1 **The contractor shall comply with following towards Social Accountability;**

a) The contractor shall not employ any employee less than 15 years of age in pursuant to ILO convention. If any child labour were found to have been engaged, the Contractor shall be levied with expenses of bearing his education expenditure which will include stipend to substantiate appropriate education or employ any other member of family enabling to bear the child education expenditure.

b) The contractor shall not engage Forced/Bonded Labour and shall abide by abolition of Bonded Labour System (Abolition) Act, 1976.

c) The contractor shall maintain Health & safety requirement as stipulated in the Contract and Contract Labour (Regulation & Abolition) Act, 1970.

d) The Contractor shall abide by UN convention w.r.t Human Rights and shall be liable for Decimation/Corporal punishment for failure in meeting with relevant requirements.

e) The Contractor shall abide the requirement of Contract Labour (Regulation & Abolition) Act, 1970 for working hours.

f) The Contractor shall abide by the statutory requirement of Minimum Wages Act 1948, payment of Wages Act 1936.

g) The Contractor shall arrange potable drinking water to its employees & workers.

1.2 Tenderer may note that as the place of work is inside the POWER PROJECT and being manned by Security/Safety Force of Ministry of Energy, DRC/AIL, all necessary system related to entry of men, vehicles & materials, safety & security systems, work permit system etc. as applicable will have to be followed by the contractor.

2 Preliminary & Civil Works

2.1 The contractor shall as a first field activity check all the foundations for the correctness of the same as per the drawings and satisfy himself in all respects such as location of foundations, absence of voids, **levels**, correctness of **bolt holes, pocket levels**, centre lines etc. and all measurements should be recorded and submitted to engineer **for approval** before erection.

2.2 Before starting erection job, contractor shall ensure that area connected to his scope of work is sufficiently enclosed against ingress of dust and water and all debris have been cleared of from the floor to a designated area as per instruction of engineer. The contractor shall arrange to get the working area and surroundings cleared daily to ensure the dust free atmosphere for working and shall maintain sufficient labours for general cleaning of work areas. Delay of work on this account will not be acceptable.

2.3 The contractor shall cover all opening on floor and put temporary hand railing on all sides of the floor to avoid any accident to the working personnel.

2.4 Contractor shall fix up and maintain plates, supports for X & Y axis and elevation at different locations as required for each unit and transfer the same from bench mark and XY axis given at one point by Civil agency/client. Joint protocol/records for such benchmarks shall be got signed from BHEL Engineer, AIL's/WAPCOS's Supervisory and QA Engineer.

2.5 Once X-Y axis and elevation are fixed at different floors and protected, marking for other equipment's shall be transferred from these and joint protocol as above shall be got signed for each equipment or as per requirement of the drawings.

2.6 All matching surfaces of components shall be well cleaned with cleaning agent and burrs shall be removed by filing and blue matched. Wherever necessary sealing/lubricating/anti-seize compounds shall be applied as per recommendation of Engineer. Machining/grinding required for fitting of keys, pins, packers, dowels etc. shall be carried out by contractor.

2.7 The accuracy of all T&Ps/IMTEs/equipments/ instruments and its functioning shall be established before they are permitted for use on the job. If the Engineer doubts the accuracy of the precision tools, at any time during erection, the contractor shall arrange for calibration of tools/ equipment/ instruments at his cost.

2.8 All the works shall be performed to the lines, grades and elevations indicated in the drawings. The contractor shall be responsible to locate and layout the works. The horizontal & vertical control points established by the engineer shall be used as datum

for the works under this contract. Any work done without being properly located may be removed and dismantled by the Engineer at the contractor's expenses if the contractor refuses to do it.

2.9 The contractor shall create all the facility at storage site as per the tender scope of work for safekeeping material, proper record and well protected. No material should be lying loose anywhere in the power house/ other work area as well as in stores.

2.10 De-watering of the areas/ floors in general will be carried out by AIL. However contractor has to take care of general cleanliness in his area of work. For area cleaning within the premises of his work, the cleanliness shall be the total responsibility of contractor. Contractor within his scope of work shall keep the separate gang of workers for cleanliness operations. If the area under the scope is found unclean, BHEL can take measures on its own for cleaning and deduct the amount so spent from the running bills of contractor.

2.11 Necessary civil works shall be done by AIL. The dimensions & locations shall be checked by the contractor for its correctness as per drawings. Further, top elevation and axis/ centrelines of all the foundations shall be checked with respect to benchmark etc. During the civil works, contractor shall check for all the block-outs, dimensions as required in its various mechanical drawings for installation of components/ assemblies and help BHEL wherever required for checking. All minor adjustments of foundation level, dressing and chipping of foundation surfaces up to 25 to 50 mm, enlarging the pockets in foundations etc., and repair of same as may be required for the erection of equipment shall be carried out by the contractor within the finally accepted rates.

2.12 Besides above, any works required for safe and efficient operation of tools and tackles like grouting/ excavation/ casting of foundation/ anchor points for derricks, winches, guy ropes fastening scaffoldings etc. or any other temporary supports shall also be the contractor's responsibility. For these works all materials including cement/ steel and required facilities will have to be arranged by contractor at his own cost.

2.13 While on the job, care is essential to avoid too much chipping and resultant lowering of level. In case of excess chipping, contractor has to arrange additional packing plates as per requirements provided BHEL Engineer allows it. When required as per drawings/ Manufacturing Unit, the embedded sole plates shall be scraped and checked with Prussian blue to get the required contact with frames at no extra cost to BHEL.

2.14 The contractor shall ensure perfect matching of packer plates including scraping and blue matching with foundation by dressing the foundation, as well as perfect matching between the packer plates and the base plate of equipment to the satisfaction of BHEL Engineer.

2.15 The contractor shall provide his T&P stores for special tools and instruments at a convenient place near to the working area.

2.16 All mechanical works of machine related to civil works including foundations, grouting, concreting, erection of chequered plates along with embedment in concrete, grouting of liners, any civil works relating to setting of anchor bolts and foundation bolts including preparation of bolt holes will be in the scope of contractor.

2.17 BHEL's consortium partner, AIL has provided open store of approx. 4000 Sq. m. (may be increased to 4000 sq.m, if required) fenced from all sides with entrance, semi closed storage area of 400 sq.m and closed storage area of 600 sq.m about 1/2 km from Powerhouse. The materials received from various MUs/Vendors are being unloaded by AIL in these storage area. Contractor shall take the custody of the material unloaded in stores by AIL and start storage & preservation activity there of as per scope of material handling work.

Ministry of Energy, DRC/AIL shall be providing the General Security arrangement at stores and powerhouse. However, responsibility of security/ watch & ward arrangement of plant material/equipments during handling & storage in BHEL stores, in stores of contractor, in power house and all plant and equipments whether erected/ yet to be erected shall lie with the contractor.

3 Materials Management at Stores & Power House

3.1 The scope of work mainly involves proper storage, stacking/ re-stacking of materials/ equipment in closed storage shed/semi-closed storage shed /open storage area/ project sites, verification of components including opening of cases, re-packing/ stacking and preservation of the same after verification including security arrangement (for details refer cl. 2.17, Chapter 2, Part-II of TCC) of plant materials/equipments shall lie with the contractor. Firefighting equipments including fire extinguishers is to be provided in closed/semi closed storage shed, open storage area and power house/other work area. Scope also includes loading and transportation of materials to erection site as and when required. The contractor shall have arrange/depute Hydra/Mobile Cranes and trucks/trailers of suitable capacity for the above work. Any other T&P required for transportation and material handling shall be arranged by the contractor.

The contractor shall maintain record of material such as receipts, issue, return, in Day – Book, ledgers, stock registers and record in computers, issue gate passes, record of shortages & MDR etc. as per BHEL procedures/standard and instructions. The contractor shall also assist BHEL for all correspondence regarding the insurance including preparation of claims.

3.2 Approx. weight to be handled as per scope of work for material handling as mentioned in the clause 2, Chapter-II, Part-I of TCC for all four units is of the order of 4400 MT (Refer Clause 4, Chapter-IV, Part-I of TCC). But the contractor required handling whatever actual materials are dispatched for the project irrespective of variations in weight and dimensions. Some equipment as per the direction of engineer may be unloaded in powerhouse with the help of EOT crane from the truck/ trailers depending upon the requirement. Further handling as per scope mentioned in Cl. 3.1 above & Cl. 2 , Chapter –II, Part-I of TCC. The bidders are required to take note of above points while quoting.

3.3 Clause 4, Chapter-IV, Part-I of TCC gives the general idea for tender's information about the weights and dimensions of some major components/ equipments. The weights and dimensions shown are approximate and are liable to vary.

3.4 The contractor shall deploy adequate number of supervisors, storekeepers, riggers, carpenter, fitters and other skilled, semi-skilled and unskilled workers as per requirement having adequate experience of jobs of similar nature till completion of work.

3.5 Contractor shall provide all necessary preservatives, paints, thinners, rust preventives, grease, lubricants etc. for preservation of components of all materials during storage at his own cost. All tools and tackles and other consumables required for preservation of components including supervision shall also provide the contractor at his own cost. Preservation of components also includes applying preservatives, paints, rust

preventives, greasing of threaded portions, repainting of work order no. / DU no. /Component codes etc. After preservation wherever necessary, components will be stacked properly as per original stacking for which no additional payment shall be made.

3.6 The contractor is required to take over material immediately after its unloading at BHEL stores by AIL and indemnify BHEL for the same in the form of INDEMNITY BOND (or equivalent document) .

3.7 Any discrepancy/ shortage/ damage found in the consignment after taking over from AIL after giving clear receipt (by AIL) would be the responsibility of the contractor and the amount liable to be lost by BHEL on such accounts is recoverable from the contractor.

3.8 In case of apparent damages/ shortages in consignments/ packing noticed by the contractor, such cases shall be brought to the notice of BHEL and cleared only with their consent/ approval. The contractor shall provide all the necessary assistance to BHEL for lodging the insurance claim and all correspondence with the insurer, surveyor and transport agency. The contractor shall also help in maintaining all the records in connection of insurance claims.

3.9 It would be responsibility of the contractor to help AIL in examining the packages, consignments etc. on arrival and bring to the notice of carriers and BHEL authorities regarding loss/ damages, if any, observed in the consignments proposed to be taken delivery of.

3.10 Before taking delivery, particularly of consignments in 'smalls' the weight of the package shall be checked with the invoiced weight of the packages and any discrepancy shall be reported immediately to BHEL/ AIL. In all case of loss/ damages the contractor will take open delivery from the carriers and forward such open delivery certificates (ODC) to the engineer within 15 days of receipt of such consignment. All expenses connected there with shall be to the account of contractor. BHEL reserves right to claim losses, if any, accrued to BHEL in the event of contractor non-compliance to above.

3.11 In case of short delivery and non-delivery, immediate notice of loss shall be filed with the carrier at places of dispatch and destination as also at any intermediate stations, if it is different one, under intimation to BHEL authorities at site.

3.12 BHEL reserves the right to recover from the contractor any loss which arises out of undue delay/ discrepancy/ shortage/ damages or any other cause during transit between the BHEL open storage yard/ semi closed storage shed/closed storage shed to project site/any other work site or during loading/unloading at BHEL open storage yard/ semi closed storage shed/closed storage shed storage yard/ store shed/ project site or during re-stacking/stacking or any time during the custody of contractor.

3.13 Loading to truck/trailers, transportation, unloading at powerhouse/ other work site of heavy sophisticated equipment like stator, shafts, runner, panels etc. shall be done in the presence of and as per the directions of BHEL representative, including stacking and re-stacking, if necessity arises.

3.14 Since the trucks/ trailers are expected to arrive during any time of the day/ night, the contractor shall have his workmen round the clock at site as well as other places as required during unloading the materials by AIL, for their scope of works.

3.15 Consignments coming on Sundays/ Holidays are also required to be taken over by the contractor promptly. It will be the responsibility of the contractor to contact the site engineer /authorized representative of BHEL at their residence at site, if required, and obtain instructions to make suitable arrangements.

3.16 Under the scope of this contract, it shall be the responsibility of the contractor to provide all necessary facilities to open the packages in the presence of the engineer, verifying the contents of the packages, repackaging where ever and whenever necessary, properly stacking them as may be directed by the engineer so as to facilitate proper handling, periodical verification of material, receipt position, stock taking etc. for this, the contractor shall have experienced person at site who can maintain the records of dispatch/ receipt/ stacking/ verification/ shortages/ damage/ missing items etc. The verification of materials shall be carried out within 30 days after taking over materials from AIL and report shall be submitted as a documentary proof.

3.17 All material shall be stored 4/6 inches above ground level by use of concrete or wooden sleepers. No material shall be left to remain on ground at any time. Material shall not be stacked in low-lying areas where it is likely flooded during rains. Wooden sleepers/ concrete block and tarpaulins for this purpose, wherever deemed necessary be arranged by the contractor. These items shall be stacked/re-stacked/stored properly at the location(s) specified by BHEL when not in use.

3.18 It is possible that certain heavy items/ consignments will require fabrication of temporary steel coverings over it. These shelters will be covered with suitable CGI sheets or tarpaulin. The contractor will be required to fabricate such sheds. All materials for these will be arranged by Contractor. All expenses towards manpower, T&P, consumables, etc. will be borne by the contractor. After completion of the work the contractor will dismantle the same and the material shall be retained by the contractor. Contractor shall be paid @USD 200/MT for such works.

3.19 The material/ equipment requiring indoor storage will be handed and stacked inside the BHEL semi-closed/closed storage shed by the contractor using material handling equipment like Hydra crane, Fork lift etc.

3.20 For checking/ verification of the components with packing slips/ LWB/ PWB etc. The contractor shall provide sufficient experience persons and other facilities as and when required by the engineer.

3.21 Stacking/re-stacking of the materials shall be done as per the instruction and to the satisfaction of engineer. The materials shall be so stacked that the same should facilitate easy handling. In the event of any improper stacking BHEL may ask the contractor to restack the material properly or failing which BHEL may get the job done by another agency at the risk and cost of the contractor.

3.22 The contractor shall execute the work in the most substantial and workman like manner. The stores shall be handled with care and diligence. Any loss to BHEL due to contractor's lapse /negligence shall have to be made good by the contractor.

3.23 In case contractor is not able to transport, re-stack/stack the material at a pre-determined area, as per direction of the engineer for any reason whatsoever (including non-availability of crane, tractor, trailer and other T&P etc.) BHEL shall be at liberty to get the work done by engaging other agency/ equipment / T&P etc. at the risk and cost of the contractor.

3.24 It shall be responsibility of the contractor to keep the storage areas (semi closed/closed/ open) in neat and tidy conditions. Any vegetation like grass, bushes, sarkandas etc. shall be cut in open storage area and removed as per requirement and instruction of BHEL engineer within the contractual value. All surplus/ unusable packing materials shall be removed and deposited at location(s) specified by BHEL within the project premises.

4 Material Handling and Storage & Transportation To Power House

4.1 Contractor shall plan in consultation with BHEL engineer, plant material to be received/ delivered in powerhouse as per erection progress/ schedules and fill in the requisite formats in standard forms.

4.2 Responsibility of security (for details refer cl. 2.17, Chapter-II, Part-II of TCC**)** arrangement shall lie with the contractor. In case any equipment/ material is lost/ damaged while in the custody of the contractor, the cost of repair/ replacement if any to bring back the equipment in original order shall be deducted from the contractor's bill. BHEL's decision in this regard shall be final and binding on the contractor.

4.3 All electrical panels, control gear, motors and such other devices shall be dried by heating before they are installed and energized. Exposed parts those required special protection such as bearings, slip rings, commutators and other fragile items shall be protected against moisture ingress and corrosion during storage and are periodically inspected.

4.4 Contractor shall also ensure that lifting heavy equipment such as generator rotor, stator, shafts etc. shall be done strictly in accordance with drawings given for the purpose and using of lifting tackles supplied for the purpose. Wherever required rubber/ leather pads shall be given between the slings and the machined parts to avoid any damages, scratches to the machined surface. Contractor shall cover bearing journals with grease and cloth as per direction of engineer to avoid damages to the surface.

4.5 As per the erection requirement contractor shall deliver material to powerhouse/ other work site(s). The maximum care has to be taken during that time of loading the material at stores, transportation and unloading at powerhouse/other work area. No untoward damage should occur to the material at that time. Any loss of item/ damages shall be to the contractors account.

4.6 It shall be responsibility of contractor to protect the material from rain water during storage, transportation and unloading. Any damage to the material due to this reason shall be in contractor's head.

4.7 Please also refer Clause 6.1 of SCC in this regard.

5 Preservation of Components

Contractor has to store all items in closed storage shed which require indoor storage not limited to bolts, pins, packing, tools, insulation materials, electrical parts with electrical devices attached, electric motors, electronic Panels, excitation equipment, automation equipment and associated equipment/consumables, instruments, welding material and equipment, all small parts and all parts of the plant which already have been finally painted etc. Partition required inside the closed storage shed for proper storage of items, shall be done by contractor.

Humidity inside the covered store shall be maintained within limits as specified in the storage instructions. Thermometer cum Hygrometer shall be installed in the closed storage shed for temperature and humidity measurement.

For turbine and generator items, storage & preservation shall be done as per storage & preservation manuals enclosed as Annexure -III

Instruments are to be repacked with adequate cushioning and protection against impacts. All instruments should be stored in a vibration free area. Packing cases containing instruments are marked ‘fragile’. Jerks and impacts should be avoided in handling these.

The packaging and storage of electronic equipment shall be strictly in accordance with internationally accepted standards. Electronic equipment shall be stored in anti-static packing. Packages containing electronic equipment shall be stored in humidity controlled environment.

In addition to the above, preservation of the other component shall be done as per Cl. 6.2 of SCC.

6 Cleaning of Equipments

6.1 The contractor shall thoroughly clean all the components before installation of the components whose surfaces are coated with protective coating and sent to site are to be thoroughly cleaned by suitable mechanical/ chemical means as per the approved procedure.

6.2 Contractor shall ensure that the items identified by BHEL shall be cleaned with kerosene/ petrol/ CRC before assembly and erection of the equipment. For cleaning purposes he shall use only soft cotton cloth. Contractor shall avoid use cotton waste for cleaning any equipment. The electrical equipment before erection shall be cleaned with dry air/ vacuum cleaner.

6.3 The contractor shall clean inside of all pipes and fittings from dirt, sand and loose scales, mechanically/ chemically and by air blowing before being erected. All pipe lines be thoroughly blown/ flushed. If necessary certain pipelines may have to be cleaned by acid pickling/ chemical cleaning. The procedure for the same shall be provided by BHEL. All chemicals and inhibitors shall be arranged by the contractor within the contract. Disposal of chemical has to be carried out by the contractor at his own cost.

7 Erection

7.1 All works such as cleaning, checking, levelling, blue matching, aligning, assembling, temporary erection for alignment dismantling of certain equipment for checking, cleaning, surface preparation, fabrication at site, cutting, grinding, straightening, chamfering, filing, chipping, drilling, reaming, dowelling, scrapping, machining, surface grinding, shaping, fitting up welding, tube expansion etc. as may be applicable in such erection works are to be treated as incidental to erection and necessary to complete the work satisfactorily & shall be carried out by the contractor as part of the work.

7.2 Any fixtures, scaffolding materials, approach ladder, concrete block supports, steel structures required for temporary supporting, pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost within the finally accepted rates.

7.3 No members of the ladder/ structure/ platform should be cut without specific approval of BHEL. In case it is necessary to cut, the contractor shall rectify/ repair in a manner acceptable to BHEL/ Customer without any additional cost.

7.4 The contractor shall erect scaffolding/ temporary platforms for erection. These should be of adequate capacity and shall never be over loaded. These should be replaced when not found suitable during erection work and dismantled on work completion & removed from work site.

7.5 Corrections like straightening of ladders, tube support plates adjustment/ removal of ovulates in pipes and opening or closing the fabricated bends of piping to suit the layout shall be considered part of the work and the contractor is required to carry out such work within finally accepted price/ rate as per instructions of Engineer.

7.6 The contractor shall fabricate pipes, special bends, etc. threading and welding as required and carry out the chemical cleaning of fabricated piping.

7.7 The servicing and realignment of skid-mounted equipment if required or if directed by BHEL shall be carried out by the contractor at no extra cost to BHEL.

7.8 The contractor shall completely erect & test all the piping systems, covered in the specification including sampling lines up to and including sample coolers, hangers & supports, valves & accessories in accordance with the drawings furnished. This includes all necessary bolting, welding, pre-heating, stress relieving, testing, cleaning & painting. System shall be demonstrated in condition to operate continuously in a manner acceptable to the Engineer. Welding shall be used throughout for joining pipes except

where flanged screwed or other type joints are specified or shown on the drawings. All piping shall be erected true to the lines & elevation as indicated in the drawings.

7.9 Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths. Bends shall be prepared and/or fabricated at site.

7.10 The contractor shall depute sufficiently qualified crane operators/drivers for EOT & mobile cane for erection & material handling activities.

7.11 The contractor shall ensure lowering of pipes in position with adequate precautions as to avoid any damage to either material or men. Only the anchoring points earmarked for the purpose of lowering the pipes are to be used.

7.12 Certain adjustments in length may be necessary while erecting pipelines. The contractor should remove the extra lengths/ add extra lengths to suit the final layout after preparing edges a fresh by adopting specified heat treatment procedures, at no extra cost.

7.13 It is possible that a few flanges may not be matching. The contractor shall be required to cut and re-weld the same as and when required without any additional cost.

7.14 The contractor shall be responsible for any modifications of shop fabricated pipes prior to installation to accommodate minor site alteration in pipe routing at no extra cost.

7.15 Special Tools and Tackles provided by BHEL to the contractor for erection/commissioning purposes, has to be maintained in good condition. It shall be responsibility of the contractor to address the observations of the customer during handing over these items.

7.16 Some component may require minor machining/ turning/ drilling to facilitate assembly at site. For this contractor shall deploy suitable drill machine & lathe as envisaged in list of tools & plants. The contractor shall deploy one machinist/turner at site for this purpose. The above arrangement should be included in the finally accepted rate, such machining shall be at no extra cost to BHEL.

7.17 All vents and drains for piping equipment covered in the scope whether shown in the drawings or not shall terminate in atmosphere and to pit as directed by BHEL.

7.18 Acid pickling and preservation of erected oil pipelines shall be done in accordance drawings/ instruction of BHEL engineer.

7.19 Oil flushing of Oil pipelines should be done in accordance to instruction of BHEL engineer for start/ during pre-commissioning.

7.20 Wherever piping erected by the contractor is connected to equipment/ piping erected by the other agencies the joint at the connecting point shall be the responsibility of the contractor of this specification.

7.21 Normally the valves will have prepared edges for welding. But, if it becomes necessary, the contractor will prepare new edges or recondition the edges by grinding or chamfering to match the corresponding tubes and pipes. All fittings like `T' pieces, weld neck flanges, reducers etc., shall be suitably matched with pipes for welding. The valves will have to be checked, cleaned or overhauled in full or in part before erection after chemical cleaning and during commissioning.

7.22 The contractor shall be responsible for correct orientation of all valves so that seats, stems & hand wheels will be in desired location. It is the responsibility of the contractor to obtain the information regarding orientation of valves not fully located on drawings before the same are installed.

7.23 Suspension for piping, etc., will be supplied in running lengths, which shall be cut to suitable sizes and adjusted as required.

7.24 The adjustment of all supports erected for maintaining the proper slopes of piping wherever required is also included in the scope of the contractor.

7.25 No temporary supports should be welded on the piping. In case of absolute necessity prior approval should be taken from BHEL Engineer. In such cases heat treatment if required, shall be carried out by the contractor as part of subject work.

7.26 All supports and anchors shall be installed as per drawing to obtain safe and reliable and complete pipe installation as per instructions of Engineer. Any additional support as called for by Engineer shall have to be fabricated and provided by the contractor. The raw materials required for fabricating such supports shall be arranged by BHEL.

7.27 Contractor shall install piping in such a way that no excessive or destructive expansion forces exist under any condition.

7.28 The contractor shall carry out the tightening of the field bolts on the equipment and piping covered under this specification by using either the calibrated torque wrench method or the turn of part method. The methods used, the tools and the equipment deployed shall be subject to the approval of Engineer. All the torque wrenches shall be

calibrated at the start of each day work and at least once during the day. The bolting work shall be carried out by the competent technicians.

7.29 The contractor shall ensure that all supporting elements, anchors & restraint have been installed and adjusted in accordance with the drawings / sketches & other written instructions of the Engineer.

7.30 Layout of small bore piping as required shall be done as per site requirement. Necessary sketch for routing these lines should be got approved from BHEL by the contractor. There is a possibility of slight change in routing the above pipe lines even after completion of erection or from aesthetic point of view which should be carried out at no extra cost.

7.31 All the valves, including motorised valves, flap valves, etc. shall be serviced and lubricated to the satisfaction of Engineer before erecting the same and during pre-commissioning also. Welding or jointing of extension spindle for valves to suit the site conditions and operational facility shall be part of erection work within the quoted rates.

7.32 Additional platforms and ladders of permanent nature incidental to the job for approaching different equipment/ valves as per site requirement, which may not be indicated in drawings, shall be fabricated and installed by the contractor. The materials required will be supplied by BHEL free of cost.

7.33 Erection and welding of necessary instrumentation tapping points, valves to be provided on equipment, auxiliaries and pipe lines covered within the scope of this specification will also be the responsibility of the contractor and will be done as per the instructions of BHEL Engineer at no extra cost.

7.34 All the items will be supplied in pieces/ loose and are to be assembled bolted and welded at site. Contractor has to work as per the drawings and instruction issued at site for erection and testing purposes. Weights for handling and erection in the Clause 4, Chapter-IV, Part-I of TCC are indicative only. No claim will be entertained on account of variations in weights or change from conventional design e.g from bolted to welded connections and vice versa, increase in number of pieces etc. The bidders should take care of this point while quoting lump-sum price for subject works for handling and erection works.

8 Welding & NDT

8.1 The equipment and piping shall be erected in conformity with the provisions of standard/ specification and as may be directed by BHEL. The method of welding (arc, gas, TIG, MIG or other method) may be indicated in the detailed drawings/ schedules. BHEL Engineer will have the option of changing the method of welding as per site requirements.

8.2 Welding being a special process, all-welding shall be carried out by skilled and experienced welders holding valid certificates as per requirements of ISO 9002. *The certificate shall be checked by BHEL before allowing the welders to be engaged on welding.* BHEL at its own discretion may ask any or all welders to undergo welder Qualification Test as per Standard Procedure in accordance with requirements of ISO 9002 and as per welding manual of BHEL. The deployment of qualified welder and subsequent site testing of requisite numbers of welders shall be one of the prerequisite of contractor's site mobilisation completion.

8.3 All welders including tack welder, structural and pipe welder shall be tested as per ASME section IX and approved by BHEL Engineer before they are actually engaged on work though they may possess the certificate. BHEL reserves the right to reject any welder if the welder's performance is not found to be satisfactory. The contractor in Performa given by BHEL Engineer shall maintain the records of qualification of welders. All the welders qualified for the work will be issued an identity card by BHEL Engineer and welder will keep the same with him at work place.

8.4 BHEL Engineer may stop any welder from the work if his performance is unsatisfactory for any technical reason or if there is a high percentage of rejection of joints welded by a particular welder which, in the opinion of the Engineer will adversely affect the quality of the welding though the welder has earlier passed the tests prescribed by Engineer. The welder's is having passed qualification tests does not absolve contractor of contractual obligation to continuously check the welder's performance.

8.5 Faulty welds caused by the poor workmanship shall be cut and re-welded at the contractor's expenses including cost of materials. The Engineer prior to any repair being made shall approve the procedure for the repair of defective welds. NDT on completed field welds shall be conducted as per drawings or instructions of BHEL engineer.

8.6 The contractor shall carry out the root run welding of all piping, valves, instrumentation, tapping points, runner envelope halves etc. by TIG/ SMAW / MIG welding process. The contractor shall have to carry out full TIG welding of butt weld joints of tubes /pipes of lesser thickness if required. During the root runs of stainless steel joints, the contractor shall before and during welding have to purge the pipes with inert gas in case of stainless

steel. All arrangements required for the above shall be the responsibility of the contractor at no additional cost.

8.7 All charges for testing of contractor's welders including consumables for welding / destructive and non-destructive tests conducted by BHEL at site or at laboratory shall have to be borne by the contractor only. The test coupons raw material will be supplied by BHEL free of cost.

8.8 The regulators used on welding machines shall be calibrated before putting these into use for work. Periodic calibration for the same shall also be arranged by the Contractor at his cost.

8.9 Only BHEL approved electrodes and filler wire will be used. All electrodes shall be baked and dried in the electric electrode-drying oven to the required temperature for the period specified by the Engineer before these are used in erection work. All welders shall have electrodes drying portable oven at the work spot. The electrodes brought to the site will have valid manufacturing test certificate. The test certificate will have co-relation with the lot No. /batch No given on electrode packets. No electrodes will be allowed to be used in the absence of above requirement. The thermostat and thermometer of electrode drying oven will be also calibrated and test certificate from Govt. approved / accredited test house traceable to National / International standards will be submitted to BHEL before putting the oven in use. Periodical calibration for the same shall also be arranged by the contractor within the finally accepted rates.

8.10 All butt / fillet welds shall be subject to Dye Penetration test as per drawing and document requirement and have to be carried out as per the instructions of the engineer within the quoted / finally accepted rates for this contract.

8.11 The contractor shall maintain a record in the form as prescribed by BHEL of all operations carried out on each weld and maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required. Interpretation of the BHEL Engineer regarding acceptability or other wise of the welds shall be final. All site welding joints shall be subject to acceptance by BHEL Engineer.

8.12 All welds shall be painted with anticorrosive red oxide paint once welding and stress reliving works are over. Necessary consumables and scaffolding etc. including paints shall be provided by contractor at his own cost.

8.13 The contractor shall carry out the edge preparation of weld joints at site in accordance with the details acceptable to BHEL. Wherever possible machining or automatic flame

cutting will be allowed only wherever edge preparation otherwise is impractical. All slag's / burrs shall be removed from cuts and all the hand cuts shall be ground smooth to the satisfaction of engineer.

8.14 Pre-heating, NDT tests, post heating and stress relieving after welding of tubes, pipes, including attachment welding wherever necessary, are part of erection work and shall be carried out by the contractor in accordance with the instructions of Engineer. All equipment and consumables essential for carrying out the above process shall be arranged by contractor at his cost.

8.15 Contractor shall arrange all necessary stress relieving equipment with automatic recording devices. Also the contractor shall have to arrange for labour, heating elements, thermocouples, etc. insulating materials like asbestos cloth, ceramic beads, asbestos ropes etc. required for heat treatment/ stress relieving operations. Temperature shall be measured by thermocouple and recorded on a continuous printing type recorder. All the recorded graphs for heat treatment works shall be the property of BHEL. The contractor has to provide thermal chalks, temperature recorders, thermocouple attachment units, graphs sheets, etc. for checking within the finally accepted rates. All stress relieving equipment will be used after due calibration and submission of test certificate to BHEL. Periodic calibration from Govt. approved / accredited Test Houses traceable to National / International standards will also be arranged by the contractor for such equipment at his cost. The contractor shall obtain the signature of BHEL Engineer or his representative on the chart of the recorder after setting up the weld joints for heat treatment operation prior to the starting.

8.16 The contractor shall be equipped for carrying out other NDT like DP/ MPI / UT etc. as required as per welding schedule/ drawings within the finally accepted price/ rates. Necessary help including surface preparation and scaffolding required for conducting all the arrangement shall be rendered by contractor at his own cost.

8.17 The technical particulars, specification and other general details for NDT work shall be in accordance with ASME, ISO or as specified by Drawings and Manuals of BHEL/ WAPCOS.

8.18 The contractor shall assist BHEL Engineer in preparing complete field welding schedule/procedure for all the field welding activities to be carried out in respect of piping and equipment erected by him involving high pressure welding at least 30 days prior to the scheduled start of erection work at site. Such schedules shall be strictly adhered to by the contractor.

9 Testing, Pre-Commissioning, Commissioning & Post-Commissioning

9.1 On completion of erection of equipment, the contractor shall get the equipment checked up by the BHEL/WAPCOS/Customer and their deputed supervisors, specialists concerned with the particular item of work. The testing of various equipment will be carried under the supervision of BHEL/WAPCOS/Customer with the assistance of the Contractor in the manner decided by and in the presence of the owner and other authorised supervisors concerned, and to their entire satisfaction. On completion of these preliminary checks by the equipment supplier, the contractor shall make the equipment ready for conducting the test. The contractor shall rectify all defects found during the checking / testing as directed by the BHEL/WAPCOS/Customer to ensure satisfactory operations of the equipment.

9.2 The contractor shall carry out the required tests as instructed by BHEL using contractor's own consumables, labour and scaffoldings.

9.3 All the tests shall be repeated till all the equipment satisfy the requirement / obligation of BHEL at various stages. Contractor shall also carry out repair of all the welded joints (site and suppliers) failed during testing.

9.4 The scope of testing activities cover installation of all necessary temporary piping, supports, valves, blanking, pumps, tanks etc. and other accessories with access platforms valves, pressure gauges, electric cables, switches, cutting of some of existing valve, placing of rubber wedges in the valves etc., required for hydro test, chemical cleaning, or for any other tests as the case may be and will carry out above activities under this scope of work as per instructions of BHEL. The scope also covers the off-site disposal of effluents.

9.5 For hydraulic testing of pipes, the blanking plate/flanges shall be supplied by BHEL. Any other item which may be required additionally shall be arranged by contractor. The necessary blanks, pressure gauge, valve etc. for testing of piping system including hardware shall be arranged by the contractor within his scope of work.

9.6 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors including necessary consumables, T&Ps, IMTEs etc., and any other assistance required during testing of equipment and attending any problem in the equipment erected by the contractor till handing over. Association of BHEL's/ Client's staff during above period will not absolve contractor from above responsibilities.

9.7 It shall be specifically noted that the above employees of the contractor may have to work round the clock along with BHEL Engineers and hence overtime payment by the

contractor to his employees may be involved. The contractor's finally accepted rates/ price shall be inclusive of all these factors also.

9.8 In case, any rework is required because of contractor's faulty erection which is noticed during testing, the same has to be rectified by the contractor at his cost. If any equipment/ part is required to be inspected during testing, the contractor will dismantle /open up the equipment / part and reassemble / redo the work without any extra claim.

9.9 During testing, opening/ closing of valves, changing of gaskets, realignment of rotating and other equipment, attending to leakage and adjustments of erected equipment may arise. The finally accepted price shall also include all such work.

9.10 The contractor shall make all necessary arrangements including making of temporary closures on piping/ equipment, if not supplied by BHEL, for carrying out the hydro test on all piping equipment covered in the specification at no additional cost.

9.11 In case any defect is noticed during tests such as loose components, undue noise or vibration, strain on connected equipment etc., the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the same shall be done as per Engineer's instructions including repair, rectification and replacement work by the contractor at his cost. The parts to be replaced shall be provided by BHEL.

9.12 The contractor shall carry out cleaning and servicing of valves prior to testing of the equipment under his scope. A system for recording of such servicing operations shall be developed and maintained in a manner acceptable to BHEL Engineer to ensure that no valves are left un-serviced. Wherever necessary as required by BHEL Engineer, the contractor shall arrange to lap / grind valve seats.

9.13 Cleaning & servicing of all the filters/ strainers, toppings of oils coming in the system shall be done by the contractor within the accepted price.

9.14 Besides the routine tests during erection, pre commissioning & commissioning shall include HV test, bearing heat run, Over-speed test, SCC, OCC, load rejection tests in stages up to 110%, emergency stop tests, turbine & generator output tests, vibration measurement & balancing etc. on all the units and field efficiency test and type test on one unit. Inspection of the units shall be carried out after load throw off tests and re-tightening of wedges, fasteners etc. shall be carried out.

9.15 The contractor shall provide sufficiently skilled manpower support & required/ calibrated IMTEs to BHEL engineer for pre-commissioning, testing and Commissioning of the system.

9.16 Cleaning and Oil Flushing of Oil pipelines of governing system/ lub oil system shall be done at site. Necessary temporary arrangement required to done at site for oil flushing shall be done by the contractor within the accepted price.

9.17 At the time of each inspection, the contractor shall take note of the decisions / changes proposed by the Engineer and incorporate the same at no extra cost.

10 Finish Painting

10.1 Primer painting wherever peeled off or damaged or if required is to be carried out after thoroughly cleaning of all dirt, rust, scales, grease, oils and other foreign materials by wire brushing, scrapping, any other method as per requirement of BHEL and the same being inspected and approved by the engineer before painting. Bare surfaces / unpainted surfaces shall be provided with two coats of suitable primer. The gas cut stubs / weld seams would require be cleaning / grinding before painting. After applying the primer paints all the equipment / items shall be finished with two coats of enamel paint or any other paint as issued by BHEL. The exterior surface may have to be cement / coal tar painted as directed by BHEL.

10.2 As the equipment/ items are to be spray painted, the contractor shall make arrangements of the required equipment for spray painting. Spray painting at the job/ site shall be permitted only items approved by the owner / Engineer.

10.3 Underwater parts have to be painted in accordance to drawings/ standards.

10.4 While the primers and paints will be issued by BHEL as free issue item, all tools and other consumables including scaffolding materials required for finish painting shall be supplied by contractor within their quoted rate.

10.5 After commissioning, one coat painting shall be applied on the equipment for which paint shall be supplied by BHEL.

11 Any other requirement

Not Applicable

Annexure - I

4X16 MW GRAND KATENDE HEP, D R CONGO

PACKAGE WEIGHTS & DIMENSIONS

TURBINE (KAPLAN TYPE) & ACCESSORIES

S.NO.	DESCRIPTION	No. of main pieces/packages/lots	Total no. of main pieces/packages/lots	Dimension			Unit Weight	Total Wt. (4 Units)
				L	W	H		
				(mm)	(mm)	(mm)	(T)	(T)
A)	**TURBINE (each)**							
1	Pipe and embedments in first stage	1.00	1.00	----In suitable no. of packages------			49.45	49.45
2	Installation of DT Elbow Liners (22 seg)	1.00	4.00	----In suitable no. of packages------			41.44	165.76
3	Installation of DT Cone (in 6 seg)	1.00	4.00	----In suitable no. of packages------			7.90	31.60
4	Installation of Pier Nose liners (2 pieces each for left & right pier nose liners)	1.00	4.00	----In suitable no. of packages------			14.16	56.62
5	Embedded tubes for field efficiency testing	1.00	1.00	----In suitable no. of packages------				0.00
6	Installation of stay ring (stay ring in 4 pieces)	1.00	4.00	----In suitable no. of packages------			35.10	140.38
7	Installation of manhole assy of spiral access	1.00	4.00	----In suitable no. of packages------			1.33	5.33
8	Runner Enevelopes in two halves	1.00	4.00	----In suitable no. of packages------			27.76	111.05
9	Pit liners	1.0	4.00	----In suitable no. of packages------			11.86	47.44
10	Embedments & Pipes in second stage	1.0	1.00	----In suitable no. of packages------			31.17	31.17
11	Tools tackles and erection devices for foundation and embeded parts	1.0	1.00	----In suitable no. of packages------			3.55	3.55
12	Guide Aparatus (with 24 Nos. Guide vanes)	1.0	4.00	----In suitable no. of packages------			110.81	443.24
13	Tools tackles and erection devices for Guide Aparatus	1.0	1.00	----In suitable no. of packages------			1.84	1.84
14	Runner Assy (with 4 Nos. blade)	1.0	4.00	----In suitable no. of packages------			29.30	117.20
15	Tools tackles and erection devices for Runner	1.0	1.00	----In suitable no. of packages------			3.23	3.23
16	Testing devices for runner	1.0	1.00	----In suitable no. of packages------			3.53	3.53
17	Turbine shaft arrangement	1.0	4.00	----In suitable no. of packages------			14.34	57.36
18	Oil header	1.0	4.00	----In suitable no. of packages------			5.22	20.87
19	Oil tubes of runner servomotor	1.0	4.00	----In suitable no. of packages------			1.01	4.05
20	Arrgt. Of Guide Bearing	1.0	4.00	----In suitable no. of packages------			3.39	13.56
21	Arrgt. Of shaft seal	1.0	4.00	----In suitable no. of packages------			0.38	1.50
22	Monorail in turbine pit	1.0	4.00	----In suitable no. of packages------			0.68	2.73
23	Bush housing for gen shaft	1.0	4.00	----In suitable no. of packages------			0.10	0.40
24	Platform & railing in turbine pit	1.0	4.00	----In suitable no. of packages------			1.71	6.84
25	Pipes in turbine pit	1.0	4.00	----In suitable no. of packages------			4.12	16.48
26	oil pipe arrangement	1.0	4.00	----In suitable no. of packages------			3.94	15.76
27	Arrangement of HP compressed air system	1.0	1.00	----In suitable no. of packages------			3.51	3.51
28	Arrangement of LP compressed air system	1.0	1.00	----In suitable no. of packages------			3.63	3.63

29	Arrangement of cooling water system	1.0	4.00	----In suitable no. of packages------	40.18	160.73
30	Misc & other left items	1.0	1.00	----In suitable no. of packages------	150.00	150.00
31	Drainage & Dewatering system	1.0	1.00	----In suitable no. of packages------	32.00	32.00
	Sub Total					**1700.80**

MAJOR ITEMS OF GOVERNING GROUP

S.NO.	DESCRIPTION	NO. OF PACKAGES	PACKAGE DIMENSIONS (EACH)			WT.OF EACH PACKAGE	TOTAL WT. OF PACKAGE	Total Wt. (4 Units)
			L	W	H			
			(mm)	(mm)	(mm)	(KG)	(KG)	(T)
1.00	HYDRO MECHANICAL CABINET (HMC)	4.00	1700(H)	2000(W)	1700(D)	1200.00	4800.00	4.80
2.00	GOVERNOR ELECTONIC CUBICLES INCL EHGC	4.00	900.00	1100.00	2500.00	900.00	3600.00	3.60
3.00	TOOTHED WHEEL AND MAGNETIC PICK UP	4.00	1100.00	1100.00	200.00	100.00	400.00	0.40
4.00	FEEDBACK DEVICE FOR RUNNER CONTROL(LVDT)	4.00	1500.00	1000.00	800.00	100.00	400.00	0.40
5.00	FEEDBACK DEVICE FOR GV CONTROL (LVDT)	4.00	1500.00	1000.00	800.00	100.00	400.00	0.40
6.00	FEEDBACK MECHANISM	4.00	1500.00	1000.00	800.00	100.00	400.00	0.40
7.00	HYDROLIC OVERSPEED DEVICE	4.00	460.00	310.00	260.00	20.00	80.00	0.08
8.00	OIL SUMP TANK	4.00	2300.00	2200.00	2200.00	4000.00	16000.00	16.00
9.00	TURBINE FLOW MEASUREMENT EQPT	4.00	2000.00	1220.00	660.00	500.00	2000.00	2.00
10.00	MOBILE LUB OIL PURIFICATION SYSTEM	1.00	2600.00	1800.00	2100.00	2200.00	2200.00	2.20
11.00	FIRST FILLING OF OIL	4.00	------In suitable no. of drums------			5000.00	20000.00	20.00
12.00	INSTRUMENTS	1.00	-----In suitable no. of packages------				5000.00	5.00
13.00	SPARES	1 SET	-----In suitable no. of packages------				20000.00	20.00
	SUB TOTAL WEIGHT							**75.28**

MAJOR ITEMS OF HYDRO GENERATOR

S.NO.	DESCRIPTION	BOXES PER M/C	TOTAL NO. OF QUANTITY	DIMENSIONS(MAIN PACKAGE)			WT. PER M/C	Total Wt. (4 Units)
				L	W	H		
				(m)	(m)	(m)	(KG)	(T)
1.00	sole plate assy	2.00	8.00	1200.00	1000.00	1000.00	3000.00	12.00
2.00	sole plate assy (loose items)	1.00	4.00	2000.00	1000.00	1000.00	1200.00	4.80
3.00	tubes for grouting, set of shims	2.00	8.00	------In suitable no. of boxes------			750.00	3.00
4.00	sole plate extra loose items	1.00	1.00	1000.00	1000.00	1000.00	5000.00	5.00
5.00	arrgt of air cooler instn & air duct covers	2.00	8.00	800.00	800.00	500.00	350.00	1.40
6.00	stator coils	10.00	40.00	2000.00	1000.00	1000.00	8000.00	32.00
7.00	busring & turminal connector, wound stator insulation and other items	8.00	32.00	------In suitable no. of boxes------			1900.00	7.60
8.00	Stator Frame Segment	4.00	16.00	7000.00	1900.00	1650.00	6000.00	96.00
9.00	Poles	48.00	192.00	600.00	500.00	400.00	267.00	51.26
10.00	Pole fixing arrangement & poles key	3.00	12.00	100.00	1000.00	1000.00	450.00	1.80
11.00	Stator Punching	13.00	52.00	1500.00	500.00	1000.00	19800.00	79.20
12.00	Pressing plate assy	6.00	24.00	3000.00	1500.00	1000.00	11300.00	45.20
13.00	Generator shaft & oil retaining sleeve assy	1.00	4.00	4800.00	2400.00	2200.00	15355.00	61.42
14.00	Nut Guard assy	2.00	8.00	1000.00	1000.00	500.00	250.00	1.00
15.00	Tubular shaft assy	3.00	12.00	1500.00	1500.00	1500.00	1550.00	6.20
16.00	Thrust bearing arrangement	4.00	16.00	3000.00	1500.00	1500.00	5750.00	23.00

17.00	H S Lubrication system	4.00	16.00	2500.00	1500.00	1500.00	1250.00	5.00
18.00	Spider centre assy	1.00	4.00	5100.00	2400.00	4020.00	16800.00	67.20
19.00	Spider Arm	12.00	48.00	1500.00	700.00	1000.00	800.00	38.40
20.00	Spider cover	2.00	8.00	2000.00	1500.00	800.00	1000.00	4.00
21.00	Rim Punching	21.00	84.00	1200.00	700.00	1000.00	2500.00	210.00
22.00	Items for Rim Assy	7.00	28.00	1200.00	700.00	1000.00	6600.00	26.40
23.00	Fan assy	3.00	12.00	6000.00	800.00	800.00	2300.00	9.20
24.00	Collector assy	2.00	8.00	1500.00	1500.00	1000.00	800.00	3.20
25.00	Rotor connectors	6.00	24.00	1500.00	1000.00	1000.00	450.00	1.80
26.00	Rotor assy (balance wt & locked plate)	1.00	4.00	1000.00	1000.00	1000.00	500.00	2.00
27.00	Top bracket centre assy	1.00	4.00	5000.00	1690.00	3965.00	5000.00	20.00
28.00	Top bracket arm assy	8.00	32.00	3500.00	1500.00	800.00	700.00	22.40
29.00	Top bracket loose item	3.00	12.00	2000.00	1000.00	1000.00	400.00	4.80
30.00	Generator flooring	5.00	20.00	7000.00	2500.00	2000.00	10000.00	40.00
31.00	Top Air Guide segments	6.00	24.00	3000.00	2000.00	1000.00	1600.00	6.40
32.00	Brush gear assy	5.00	20.00	2000.00	1000.00	1000.00	510.00	2.04
33.00	Bottom bracket housing	1.00	4.00	4500.00	4500.00	2000.00	17500.00	70.00
34.00	Bottom bracket arm	4.00	16.00	2000.00	1500.00	800.00	2000.00	32.00
35.00	Bottom bracket centre and arm assy loose items	1.00	4.00	2000.00	1000.00	1000.00	400.00	1.60
36.00	Guide pads & guide assy	2.00	8.00	2000.00	1500.00	1500.00	900.00	3.60
37.00	Cooler fixing items, bottom oil vapour seal, guide bearing arrgmt, piping	4.00	16.00	2000.00	600.00	1000.00	750.00	3.00
38.00	Bottom air guide segments	2.00	8.00	1500.00	1100.00	1100.00	600.00	2.40
39.00	bottm air baffle segments	2.00	8.00	3000.00	1000.00	2000.00	400.00	1.60
40.00	air guide fixing (loose items)	1.00	4.00	7000.00	1500.00	800.00	550.00	2.20
41.00	air bagffle fixing	1.00	4.00	3800.00	1000.00	1000.00	500.00	2.00
42.00	turbine pit cover and loose items	2.00	8.00	3500.00	2500.00	500.00	1100.00	4.40
43.00	bottom bracket sole plate arrgmt	2.00	8.00	1500.00	1500.00	800.00	3600.00	14.40
44.00	bottom bracket sole plate embedded steel tubes, loose items etc.	3.00	12.00	2000.00	1000.00	1000.00	2000.00	8.00
45.00	brake jack assy, loose ietms, pipings and panesl	4.00	16.00	3200.00	800.00	800.00	1000.00	4.00
46.00	arrangment of stator instruments	4.00	16.00	500.00	500.00	500.00	125.00	0.50
47.00	arragmnt of bottom bearing assy	6.00	24.00	1000.00	1000.00	500.00	205.00	0.82
48.00	arrgmnt of OSD, rotor acking limit switch and loose items, RTI, TR	4.00	16.00	1000.00	1000.00	1000.00	330.00	1.32
49.00	power pack	1.00	4.00	1000.00	500.00	500.00	50.00	0.20
50.00	CO2 system (4 cylinders & fittings)	6.00	6.00	2000.00	1500.00	2000.00	9200.00	36.80
51.00	CO2 equipment piping, frame & fixing	4.00	4.00	2000.00	2000.00	2000.00	2000.00	8.00
52.00	arrgmt of dom light, rating plates, misc consumables	3.00	12.00	500.00	500.00	500.00	90.00	0.36
53.00	brush gear casing assy & fixing items and pit access door	2.00	8.00	2700.00	2700.00	800.00	1250.00	5.00
54.00	valves, fittings & instruments for barrel CW system	6.00	24.00	500.00	500.00	500.00	410.00	1.64
55.00	CW pipings	5.00	20.00	3500.00	2500.00	2000.00	5000.00	20.00
56.00	insulating material for stator winding & paint, tape and other items for Rotor & DC connection	6.00	24.00	500.00	500.00	500.00	2500.00	10.00
57.00	arragmnt of gen heater with loose items and conduit	3.00	12.00	1000.00	500.00	500.00	245.00	0.98
58.00	items for routing of cable, arrgt of brush gear, marshaling box etc.	8.00	32.00	1000.00	500.00	500.00	810.00	3.24
59.00	oil for first filling	1.00	1.00	2000.00	2000.00	2000.00	2000.00	2.00
60.00	stator lifting tackles, stools, turn buckle	3.00	3.00	1200.00	1200.00	1200.00	2900.00	2.90
61.00	hydraulic torque wrench, sweep gauge	2.00	2.00	5000.00	2500.00	3000.00	4000.00	4.00
62.00	core stools	1.00	1.00	1500.00	700.00	1000.00	1300.00	1.30
63.00	micrometer	1.00	1.00	500.00	500.00	500.00	200.00	0.20
64.00	rotor rim building equipments and rotor turning	7.00	7.00	1000.00	1000.00	1000.00	5660.00	5.66

65.00	pole lifting gear assy, withdrawal assy	2.00	2.00	1000.00	300.00	300.00	150.00	0.15
66.00	shaft stand, lifting & turning device	2.00	2.00	1300.00	1300.00	200.00	1150.00	1.15
67.00	arrgt of thrust pad and oil cooler withdrawal	2.00	2.00	1500.00	1200.00	1200.00	600.00	0.60
68.00	shaft centering items	1.00	1.00	200.00	150.00	150.00	20.00	0.02
69.00	slings, spanner, cooler blanking plate	3.00	3.00	------In suitable no. of boxes------			760.00	0.76
70.00	Spares incl 4 nos. wound pole assy, 3 sets of 1/3 stator coils (40 nos.)	14.00	14.00	------In suitable no. of boxes------			7750.00	7.75
	SUB TOTAL WEIGHT							**1158.27**

SCHEDULE OF PANELS FOR STATIC EXCITATION SYSTEM

S.NO.	DESCRIPTION	NO. OF PANELS PER SET	NO. OF SETS	DIMENSION			WIGHT OF EACH SET	Total Wt. (4 Units)
				W	D	H		
				(m)	(m)	(m)	(KG)	(T)
1.00	Regulation Panel with AVR	1.00	4.00	1.15	1.25	2.32	1000.00	4.00
2.00	Thyristor converter Panel	2.00	4.00	0.68	1.25	2.32	700.00	5.60
3.00	Field suppression Panels	1.00	4.00	1.15	1.25	2.32	1200.00	4.80
8.00	Excitation Transformer with cubicle	1.00	4.00	1.80	1.25	2.50	4000.00	16.00
	SUB TOTAL WEIGHT							**30.40**

SCHEDULE OF CABLING SYSTEM

S.NO.	DESCRIPTION		TOTAL NO. OF QUANTITY	DIMENSION			WT. PER QTY.	Total Wt. (4 Units)
				L	W	H		
				(m)	(m)	(m)	(Kg)	(T)
1.00	HT Cable	drum	10.00	650x2000			1500.00	15.00
2.00	LT Power Cable	drum	40.00	600x1500			1200.00	48.00
3.00	Control Cable	drum	35.00	600x1500			1000.00	35.00
4.00	Inst. Cable	drum	30.00	500x1500			1000.00	30.00
5.00	Cable Tray	trays	4000.00	2500x600x110			80000.00	80.00
6.00	Cable accessories	lot	1.00	------In suitable no. of boxes------			1500.00	1.50
7.00	Termination Kit	lot	1.00	------In suitable no. of boxes------			750.00	0.75
	SUB TOTAL WEIGHT							**210.25**

OTHER ELECTRICAL ITEMS

S.NO.	DESCRIPTION		TOTAL NO. OF QUANTITY	DIMENSION			WT. PER QTY.	Total Wt. (4 Units)
				L	W	H		
				(m)	(m)	(m)	(Kg)	(T)
1.00	**220 V DC Power supply system for PH**							
i	220 V battery	(2 lot)cells	220.00	2200x750x1500 for each rack			120.00	26.40
ii	220V Charger	Nos.	2.00	4000.00	1000.00	2300.00	2000.00	4.00
iii	220V DCDB	Nos.	2.00	4600.00	450.00	2000.00	2200.00	4.40
2.00	**415 V Switchgear System**							
i	UAB	Nos.	4.00	8600.00	1200.00	2100.00	5300.00	21.20
ii	SSB	Nos.	1.00	7100.00	1200.00	2100.00	6300.00	6.30
iii	Misc Boards	Nos.	5.00	1600.00	600.00	1800.00	600.00	3.00
3.00	**500 KVA DG set**							
i	DG Sets	No	1.00	7000.00	250.00	2100.00	10500.00	10.50
ii	AMF Panel	No	1.00	200.00	600.00	1800.00	1400.00	1.40
iii	Daily tank	No	1.00	1000 Ltr			800.00	0.80
4.00	Motor Control Panels	panels	36.00	1200x600x1000			300.00	10.80
5.00	UPS	No	1.00	3030.00	1047.00	2050.00	600.00	0.60
6.00	Illumination system	Nos.	2.00	MLDB 1600x600x1800			1200.00	2.40
	Lighting, fixures, wires, conduits etc.	lot	1.00	1200.00	600.00	1000.00	5000.00	5.00

7.00	Communication System	lot	1.00	1200.00	600.00	1000.00	3000.00	3.00
8.00	Protection system	lot	1.00	------In suitable no. of boxes------			5000.00	5.00
9.00	11 kV Switchgear System	Lot	1.00	------In suitable no. of boxes------			12800.00	12.80
10.00	Starter panels for turbine & generator aux.	No.	4.00				300.00	1.20
11.00	1 lot of telephone system	Lot	1.00	1200.00	600.00	1000.00	2880.00	2.88
	SUB TOTAL WEIGHT							**121.68**

CABLE IN PLACE OF BUS DUCT

	TENTATIVE LENGTH IN M							
S NO.	**DESCRIPTION**	**NO. PER UNIT**	**DIMENSIONS (EACH)**			**Weight of single unit**	**Weight**	**Total Wt. (4 Units)**
			L	**W**	**H**			
			(m)	**(m)**	**(m)**	**(Kg)**	**(Kg)**	**(T)**
1.00	Cable for main run	1 drum	2500 mm dia x 1200 mm width				12000.00	48.00
2.00	Cable for tap off	1 drum	1600 mm dia x 1000 mm width				800.00	3.20
3.00	Assy. of SPVT cubicle	1.00	1800.00	2000.00	2500.00		2500.00	10.00
4.00	Assy. Of NG cubicle	1.00	2500.00	1400.00	1600.00		1000.00	4.00
5.00	Termination kit	1 lot	2000.00	4000.00	600.00		70.00	0.28
	SUB TOTAL WEIGHT							**65.48**

HSE(MECHANICAL) & EMRP PACKAGES

S.NO.	**DESCRIPTION**	**NO. OF BOXES**	**PACKAGE DIMENSIONS (EACH)**			**WT.OF EACH PACKAGE**	**TOTAL WT. PACKAGE**	**Total Wt. (4 Units)**
			(m)	**(m)**	**(m)**	**(KG)**	**(T)**	
A	**Mechanical Workshop Equipments**	------In suitable no. of boxes------					25.00	25.00
C	**Ventilation & Air conditioning System (All covered store)**	------In suitable no. of boxes------					15.00	15.00
E	**Elevator**	------In suitable no. of boxes------					6.00	6.00
F	**EOT Cranes**							
1.00	**1 no. of 100/10T Crane for PH**	------In suitable no. of packages------					140.00	140.00
G	**Fire Detection & Fire Protection System**	------In suitable no. of boxes------					477.00	477.00
H	**CCTV System & Telephone System**	------In suitable no. of boxes------					3.00	3.00
	SUB TOTAL WEIGHT							**666.00**

SCHEDULE OF PANEL/DESK FOR CONTROL & MONITORING SYSTEM

S.NO.	**DESCRIPTION**	**NO. OF SETS**	**NO. OF PANELS/SUITES/DESKS PER SET**	**Size of each panel/suite/desk**			**WEIGHT OF EACH PANEL**	**Total Wt. (4 Units)**
				W	**D**	**H**		
				(mm)	**(mm)**	**(mm)**	**(Kg)**	**(T)**
1.00	**CONTROL BOARDS/PANELS**							
1.10	**Unit Control Board (UCB)**							
1.1.1	Control & Monitoring Panel	4.00	5 suit	3804.00	800.00	2415.00	2500.00	10.00
1.1.2	Temp. Measuremnet Panel	4.00	1.00	1000.00	800.00	2415.00	800.00	3.20
1.1.3	Inst. Panel & Gauge Panel	4.00	1.00	1000.00	800.00	2415.00	800.00	3.20
1.20	**LCB for Common Station Auxiliaries**							
1.2.1	Control & Monitoring Panel	1.00	4.00	3804.00	800.00	2415.00	2300.00	9.20
1.30	**LCB for switchyard**							
1.3.1	Control & Monitoring Panel	1.00	5.00	3053.00	800.00	2415.00	2500.00	12.50

2.00	**Computerized System in Central Control Room**							
2.10	Operator Stations	1.00	1.00	3600.00	800.00	1100.00	1000.00	1.00
2.20	Engineering tool	1.00	1.00	900.00	800.00	1100.00	100.00	0.10
2.30	Data Storage system	1.00	1.00	900.00	800.00	1100.00	100.00	0.10
2.40	Printers	1.00	3.00	2000.00	750.00	1000.00	100.00	0.30
3.00	**230 V, 1 phase , UPS System**	**1.00**	**1.00**	----In suitable no. of packages------			7000.00	7.00
4.00	**24 V DC system**	**1.00**	**1.00**	----In suitable no. of packages------			7000.00	7.00
	SUB TOTAL WEIGHT							**53.60**

Tra **TRNASFORMERS**

S.NO.	**DESCRIPTION**	**QTY. TRNASFORMER**	**TOTAL QTY.**	**DIMENSION, MM**			**Weight per Transformer**	**Total Wt. (4 Units)**
				(mm)	**(mm)**	**(mm)**	**(KG)**	**(T)**
1.00	4 Nos. 20 MVA, 11/132 KV, 3ϕ GSU transformer & accessories		4.00	7000.00	6300.00	5900.00	37000.00	148.00
2.00	1 no. 5 MVA, 132/11kv, 3 ϕ station transformers		1.00	------In suitable no. of boxes------			15000.00	15.00
3.00	4 nos. 11/0.415KV, 500 kVA, 3 ϕ Unit Auxiliaries Transformers		4.00	2700.00	2325.00	2600.00	4000.00	16.00
4.00	1000 kva, 3phase, station service transformer		1.00	------In suitable no. of boxes------			3000.00	3.00
	SUB TOTAL WEIGHT							**182.00**

MISCELLANEOUS

S.NO.	**DESCRIPTION**	**NO. OF QTY.**	**PACKAGE DIMENSIONS (EACH)**			**UNIT WEIGHT**	**TOTAL WT.**	**Total Wt. (4 Units)**
			(mm)	**(mm)**	**(mm)**	**(T)**	**(T)**	**(T)**
1.00	Tools tackles, handling & testing devices	------In suitable no. of boxes------						50.00
2.00	Other miscellaneous Mechanical/Electrical assemblies							100.00
	SUB TOTAL WEIGHT							**150.00**
	SUM TOTAL FOR MAT HANDLING							**4413.77**
	SUM TOTAL FOR ERECTION							

Note :

1. Weights and package size mentioned for the above items are tentative and may change during detail design.

2. Number of Panels, size and weight for Control & Monitoring system, excitation system, protection system, starter panels, LTAC system, DC system, MVAC system etc. shown are tentative and likely to change during detail design. Complete scope of PSNR shall be the scope of Erection Contractor.

GRAND KATENDE HYDROELECTRIC PROJECT
REPUBLIC OF KANGO
TENTATIVE CONSTRUCTION SCHEDULE

Annexure-II

ID	Task Name	Duration
1	**Grand Katende Hydro Electric Project (4x16) MW**	**908 days**
2	**E&M Package**	**908 days**
3	**Erection, Testing & Commissioning of E&M Equipments**	**757 days**
4	**Availability of Columns & Beams with roofing over area by AIL for readiness of EOT Crane**	153 days
5	Service Bay	0 days
6	Unit-1	0 days
7	Unit-2	0 days
8	Unit-3	0 days
9	Unit-4	0 days
10	**Readiness of EOT Crane in Power House**	160 days
11	Service Bay	30 days
12	Unit-1	7 days
13	Unit-2	7 days
14	Unit-3	7 days
15	Unit-4	7 days
16	**Availability of Civil Fronts by AIL for erection of Draft Tube Liners**	335 days
17	Unit-1	0 days
18	Unit-2	0 days
19	Unit-3	0 days
20	Unit-4	0 days
21	**Erection of Draft Tube Liners (E&M Works) (to be done with Hydra provided by AIL as EOT C&B will not be available by that time)**	380 days
22	Unit-1	45 days
23	Unit-2	45 days
24	Unit-3	45 days
25	Unit-4	45 days
26	**Stage - II Concreting around DT Liners up to pier nose for stay ring assy by AIL**	**375 days**
27	Unit-1	40 days
28	Unit-2	40 days
29	Unit-3	40 days
30	Unit-4	40 days

Note: The duration is tentiative may change depending upon site condition.

GRAND KATENDE HYDROELECTRIC PROJECT
REPUBLIC OF KANGO
TENTATIVE CONSTRUCTION SCHEDULE

Annexure-II

ID	Task Name	Duration
31	**Assembly of turbine foundation parts (stay ring assy) in service bay (E&M Works)**	**208 days**
32	Unit-1	21 days
33	Unit-2	21 days
34	Unit-3	21 days
35	Unit-4	21 days
36	**Lowering of turbine foundation parts (stay ring assy) and assy of pit liners (E&M Works)**	**132 days**
37	Unit-1 (by EOT Crane which will be ready by 16.07.15)	30 days
38	Unit-2 (by EOT Crane which will be ready by 16.07.15)	30 days
39	Unit-3	30 days
40	Unit-4	30 days
41	**Casting of Sprial Case -insitu concreting up to EL. 639.5 m by AIL**	**192 days**
42	Unit-1	90 days
43	Unit-2	90 days
44	Unit-3	90 days
45	Unit-4	90 days
46	**Concreting of Generator casing & Generator Floor up to El 644.5 by AIL**	**132 days**
47	Unit-1	30 days
48	Unit-2	30 days
49	Unit-3	30 days
50	Unit-4	30 days
51	**Runner Shaft assy in service bay (E&M Works)**	**160 days**
52	Unit-1	40 days
53	Unit-2	40 days
54	Unit-3	40 days
55	Unit-4	40 days
56	**Lowering of Runner Shaft, Top Cover, GA Assembly (E&M Works)**	**250 days**
57	Unit-1	45 days
58	Unit-2	45 days
59	Unit-3	45 days
60	Unit-4	45 days

Note: The duration is tentiative may change depending upon site condition.

GRAND KATENDE HYDROELECTRIC PROJECT
REPUBLIC OF KANGO
TENTATIVE CONSTRUCTION SCHEDULE

Annexure-II

ID	Task Name	Duration
61	**Lowering of Lower Bracket, Alignment & Centering (E&M Works)**	**235 days**
62	Unit-1	30 days
63	Unit-2	30 days
64	Unit-3	30 days
65	Unit-4	30 days
66	**Stator Core Assembly in Service Bay (E&M Works)**	**336 days**
67	Unit-1 (to be started since readiness of EOT Crane in s/bay)	45 days
68	Unit-2 (to be started after lowering of unit #2 stay ring assy in pit)	45 days
69	Unit-3 (In position of Unit #1 stator)	45 days
70	Unit-4	45 days
71	**Stator Winding & HV Test (E&M Works)**	**411 days**
72	Unit-1	120 days
73	Unit-2	120 days
74	Unit-3 (to compress sch, stator core assy to be done in pit, necessary arrngmt/platform in pit to be provided by AIL free of cost)	120 days
75	Unit-4	120 days
76	**Lowering of Stator (E&M Works)**	**190 days**
77	Unit-1	5 days
78	Unit-2	5 days
79	Unit-3	5 days
80	Unit-4	5 days
81	**Rotor Building (E&M Works)**	**353 days**
82	Unit-1 (to be started after lowering U#1 runner shaft assy from the position of rotor assy in s/bay)	80 days
83	Unit-2	80 days
84	Unit-3	80 days
85	Unit-4	80 days
86	**Lowering of Rotor (E&M Works)**	**280 days**
87	Unit-1	7 days
88	Unit-2	7 days
89	Unit-3	7 days
90	Unit-4	7 days

Note: The duration is tentiative may change depending upon site condition.

GRAND KATENDE HYDROELECTRIC PROJECT
REPUBLIC OF KANGO
TENTATIVE CONSTRUCTION SCHEDULE

Annexure-II

ID	Task Name	Duration
91	**Unit Axis Alignment (E&M Works)**	**303 days**
92	Unit-1	30 days
93	Unit-2	30 days
94	Unit-3	30 days
95	Unit-4	30 days
96	**Unit Boxing UP (E&M Works)**	**318 days**
97	Unit-1	45 days
98	Unit-2	45 days
99	Unit-3	45 days
100	Unit-4	45 days
101	Balance of Plants (E&M Works)	250 days
102	**Commissioning of Units (E&M Works)**	**354 days**
104	Dry Testing	30 days
105	Wet test, Synchronization & Trial Run	30 days
106	Performance Testings	10 days
107	Commissioning	0 days
109	Dry Testing	30 days
110	Wet test, Synchronization & Trial Run	30 days
111	Performance Testings	10 days
112	Commissioning	0 days
114	Dry Testing	30 days
115	Wet test, Synchronization & Trial Run	30 days
116	Performance Testings	10 days
117	Commissioning	0 days
119	Dry Testing	30 days
120	Wet test, Synchronization & Trial Run	30 days
121	Performance Testings	10 days
122	Commissioning	0 days
123	Generation from all 4 Units	0 days
124	Closing of site	70 days

Note: The duration is tentiative may change depending upon site condition.

INSTRUCTION ON HANDLING, STORAGE AND PRESERVATION OF HYDRO TURBINE EQUIPMENT AT SITE.

FIELD ENGINEERING SERVICES
ENGINEERING & DEVELOPMENT CENTRE
HYDRO – TURBINE
BHARAT HEAVY ELECTRICALS LIMITED : BHOPAL

1. GENERAL

The instructions given here serve as general guide lines for handling, storage and preservation of Hydro Turbine components sent to site in dismantled, partially assembled and fully assembled condition, depending upon the transport limitations.

2. INSPECTION ON RECEIPT

2.1 On the receipt of equipment at site, a thorough check should be made with part lists and shipping lists and any shortages/damages should be reported immediately to the underwriters under intimation to BHEL.

2.2 Items of hardware should be carefully accounted for after checking with the part list and threaded parts/machined surfaces carefully protected.

2.3 All cases containing sophisticated items like Governor cubicle, panels, instruments etc. should be carefully handled from cases and inspected for any damages on arrival. The repair and replacement of these items takes a long time and timely action can avoid delays at the time of commissioning of the unit.

3. HANDLING

3.1 General

Before unloading a packing case from the carrier, carefully observe the following instructions painted on the packing case :-

a. Weight of package
b. The marking showing the upright position
c. The marking showing the sling positions
d. Any other special instructions.

3.2 Working load should not exceed the indicated load for a particular sling and a suitable lifting gear should be selected. For all major components lifting arrangement are provided and these should be utilised scrupulously, while lifting these components. Lifting and lowering should be done without jerks or impacts. As regards sling strength, the following points should be considered.

a. Sling strength is not the same as cable strength. It varies with the way the sling is attached to the load, the angle of lift and the type of loop. The method of attachement effect sling strength because of the angle of wrap of the cable. Use a cable guard in case of smaller radius of wramp or while wrapping sharp edges.

   See ISS - 2266 of 1975 (revised) if necessary. Use a factor of safety between 6-8.

b. The angle of lift also affects the size of cable that should be used. The greater the angle between the legs of two slings, the greater are the stresses in each leg.

c. The type of loop employed also affects the load carrying capacity of the slings.

3.3 The packages should be unloaded in a covered area. After pysical varification and inspection of the item, it is imperative that the packing material is restored in original condition as majority of these items have to be stored for long periods. Hence, it is important that opening of th ecases is done with due care so as not to destroy the packing material in the process.

3.4 Heavyier items like top cover, pivot ring, stayring etc. should be handled in a manner that no distortion is developed during handling.

Adequate precautions in handling of machined parts should be observed so as not to damage the machined surfaces which are protected by a preventive coating. Items such as plastic covers, desicants should not be trown away. These should be put back in the box and the case restored to its original state as far as possible.

3.5 Packing cases containing instruments, indicators etc. are marked "Fragile" and should be handled with special care.

4. STORAGE

4.1 General :

The covered area, where the equipment is to be stored should be clean, dry and well ventilated. It should be properly treated against white ants other insects, fungus and other micro organisms. The cases should be arranged in neat stacks, away from walls and at least 100 MW above floor. The stacking shuould allow for adequate gang way to be left for inspection and cleaning. It is desirable to repaint weight, upright position indicators etc. on the side exposed for inspection. Packing cases must not be turned upside down without permission of erection supervisor.

4.2 Turbine parts like topcover, pivot ring, regulating ring etc. should be stored with their axis verical to avoid distortion. If distortion has taken place during transportation or handling some correction may be required prior to assembly. If machined surfaces coated with rust preventive paint are scarred or rusted during transportation/handling, these should be cleaned and rust preventive paint applied properly.

4.3 The following turbine parts can be stored in the open, provided they are properly packed with sealed flanges so that no water gets in.

a. Draft tube cone
b. Draft tube liner, pier nose cover.
c. Spiral casing and pit liner etc.

4.4 Parts which can be stored outside, but should be properly covered by Tarpaulin or some temporary cover and protected from rain and seepage water :

a. Pivot ring, stay ring, distributor of Pelton turbine.
b. Top cover.
c. Regulating ring
d. B.F. Valve body and door, rotary valve body and door.
e. Pressure receiver and Air receiver.

4.5 The following parts/sub assemblies should be stored inside :

a. Turbine guide bearing
b. Guide vane and regulating gear
c. Shaft gland
d. Guide vane servomotor
e. Runner
f. Shaft
g. Pressure pumping set
h. Return motion gear, air valve
i. Relief valve.
j. Assembled inlet valve.
k. Governor assembly with distributing valve.
l. Nozzle, needel servomotor, deflectors and connecting linkage.
m. All governor oil piping, including control piping compressors, governor cubicle, motor, pumps etc.
n. All instruments, gauges and electrical equipment (Arrange the small parts on the shelves to prevent their loss/damage).

Extreme care must be taken to protect the governor cubicle and hydro mechanical equipment and other governing eqipment from moisture and dirt. These are very sensitive equipments and require very careful handling.

4.6 Sufficient care should be taken to ensure that parts which go into concrete are having preventive coating on them. As soon as rust appears on them, the rust should be removed and preventive coating applied again.

4.7 All instruments after inspection should be rechecked to give adequate cushioning and stored in vibrations free area.

4.8 All small bore pipes are to be plugged. It should be ensured that these plugs are retained till the pipes are assembled. Large bore pipes are usually covered with a blank flange. These blank flanges must not be removed during storage.

5.0 STORAGE OF RUBBER SEALS :

Rubber sealing and sealing rings should not normally be stored as stock items. If however, these are required to be stored, the following instructions should be strictly adhered to :

a. All rubber parts must be stored in darkness at an even temperature of 15 degree C to 20 degree C in an unstressed condition. Large rings must not be hung on hooks or nails but laid flat to avoid distortion.

b. All rings should be liberally dressed with french chalk and be packed in light proof materials, preferably air tight tins lined with wax paper or polythene. The rings should not be packed tightly together or tied in bundles.

c. Soft packages of rings i.e. those which are not in tins or boxes, shall not be stacked to a height greater than 150 mm in order to avoid distortion of the contents.

d. Actual date of manufacture of rubber should be marked on the outside of each package. Regular inspection shall ensure that seals are being withdrawn in correct datal order and outdated stocks are not used.

e. Synthetic and natural rubber products should be stored properly marked to avoid confusion.

f. leather oil seals may be stored in mineral oil.

When stored under approved conditions the shelf life of acrylo-nitrile rubber is indefinite but the maximum combined shelf and service life of all other rubbers does not exceed six years. The storage life of rings under tropical conditons does not exceed 2 years in temperature of 50 degree C and 6 months in temperature of 65 degree C.

6.0 PRESERVATION

a. On the expiry of storage time, in accordance with the technological instructions on supply the equipment must be thoroughly inspected. In necessary cases represervation should be done after the inspection.

b. During inspection the packing is to be opened and oil is to be completely removed with scraper without spoiling the surface of the part and then finally cleaned with solvent (petrol). Self aligning bearings are to be cleaned with oil shell vitres 21 or shell tellers 27 or any other equivalent heated to a temperature of 95-100 degree C.

c. After the above cleaning, the surfaces of the parts are to be examined. In cases of corrosion on the surfaces of steel parts, it is to be removed with sand paper. Number of sand paper is to be selected on the basis of class of surface finish. Surfaces with fine surface finish are cleaned with emery paper no. 4 after applying turbine oil on it and is followed by an application of the paste of shell delonia compound which is mixed with turbine oil in 3:1 ratio by weight. (3 parts Delonia, 1 part turbine oil). When parts of important nature (e.g. screw pumps, self aligned bearings, parts of the governor etc.) have been corroded their suitablity shall be decided only by the supplier's representative.

d. Corrosion from the surfaces of the parts made from Aluminium copper and thier alloys is cleaned with pumic powder or emery paper (not coarser than no. 6) used with turbine oil.

e. After removing all the corrosion, degreasing and cleaning are done with petrol or white spirit. Cleaning with petrol is repeated several times depending upon degree of dirtness of the surface. Then the surface is thoroughly dried by wiping it with swab. The surface is then preserved. The preservation is to be carried out immediately after the above cleaning.

f. Before represervation, it is to be checked by visual inspection that on the surfaces prepared for represervation there should not be any corrosion, marks of cleaning or grease left.

RECOMMENDATION FOR PRESERVATION

Sl. No.	Description of surfaces.	Typical examples	Preparation	Preservation treatment
1.	All mated machined surfaces of the parts & fitted fasteners & polished metal (water immersed)	Pivot ring foundation ring Top cover Reg. ring, speed ring top and bottom faces and bore, hand rails and stanchines Screw threads, guide vane bedding faces etc.	As detailed in item. 6	1. Aeroshel grease 2 DTD900/4268-3 DTD900/4265 or 2. Shell hytilus or 3. Apply one coat of rust preventive paint.
2.	All machied surfaces unmated and not water immersed.	Pulley return motion gear etc.	As detailed in item. 6	Apply one coat of anti - corrosive priming paint to IS-2074-62 or Aeroshell grease as in item. 1.
3.	Un-mated water immersed machined surfaces.	Discharge ring (runner envelope) Francis runner, top cover, pivot ring & liner faces.	As detailed in item. 6	Apply one coat of anticorrosive priming paint followed by 2 coats of paint to IS 1404 - 59.
4.	Direct water passages & other water immersed unmachined surfaces.	Draft tube (internal) Guide vane, spiral casing (internal speed ring (internal) S.F. valve bore foundation ring, pivot ring, top cover (part)	As detailed in item. 6	Apply one coat of anticorrosive priming paint to IS 2074 followed by two coats of as per IS 1404-59.
5.	Unmated surfaces in contact with oil.	Main bearing housing oil sump interior servo pistons, interior of governor servo motor and components. Kaplan hubs (internal), Deriaz turbine hubs etc.	As detailed in item. 6	Apply two coats of anticorrosive priming paint (white) or oil resistant enamel paint.

6. Concrete Embedded Surfaces.	Draft tube (external foundation ring (external) pit liner (external), speed ring (external) spiral casing (External)	As detailed in item. 6	Normally untreated but for long period of storage apply one coat of rust preventive paint or cement base paint.
7. All other machined surfaces.	Pressure receivers (external)regulating ring, regulating gear, S.F. Valve (external)non embedded spiral casing (external) governor servo motors and components.	As detailed in item. 6	Apply one coat of anit - corrosive priming paint as per IS 1404 - 59.

NOTE :-

1. All the materials required for represervation e.g. petrol, oil, grease and solvents etc. are very susceptible to fire and should be placed in hermitically sealed containers in special premises free from any danager of fire. Necessary precautions against fire are to be taken and fire fighting facilities should be available in the premises.

2. References made to paint/grease etc. are all available indigenously.

FILE NAME : FES

STORAGE AND PRESERVATION MANUAL

CONTENT

STORAGE AND HANDLING INSTRUCTIONS

1.1 GENERAL

1.1.1 The instructions given here are to serve as compendium for storage and handling of the Hydro generator components.

1.1.2 The technology of packing and also design of components are constantly being improved and hence the instructions given here are subject to modifications. Effort has been made to cover as many aspects as can be foreseen at the moment. The aim of proper storing and handling is to ensure trouble free erection and operation. It has been pre-supposed that the operators and supervisors who will handle these are conversant with general engineering practices and sufficiently skilled in material handling.

1.2 RECEIVING AND UNLOADING

1.2.1 The components are packed for their safe transportation from the manufacturer's works to the site and this packing is unsuitable for long time storage in open air after the packages have reached the erection site.

1.2.2 Before unloading a packing case from the carrier, the following instructions painted on the packing case should be noted.

(i) Weight of the package.

(ii) Marking showing '**THIS SIDE TOP**'

(iii) Marking showing the '**SLING POSITION**'

1.2.3 For all major components, lifting arrangement drawings are supplied. These should be consulted while lifting these components.

1.2.4 Suitable lifting tools/tackles should be selected. The lifting tackles, which are properly certified by appropriate authority about load carrying capacity, should only be used. All tackles should be properly maintained. If the sling marks are not provided on any of the packing for lifting, the sling should preferably make an angle of not more than 30^0 to the vertical, and in no case more than 45^0 while lifting the packing.

1.2.5 Lifting should be done without jerks and impacts.

1.2.6 While handling the packing, the warnings indicated by markings and inscriptions on the Packing boxes such as **"HANDLE WITH CARE**", **"THIS SIDE TOP**", **"NOT TO PUT LOAD ON THE TOP**", **"SLING HERE**" etc. shall be strictly observed.

1.2.7 On receipt of the equipment check them with the packing list. Any omissions and damages should be reported back to Hydro Sales Services Division, BHEL, immediately. This checking should be preferably done in the presence of BHEL's representative posted at site. At the time of inspection the case should be opened carefully so as not to destroy the packing material in the process so that it can be re-used.

1.2.8 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully after inspection of the component. Some packing cases may contain VCI (Volatile corrosion Inhibitor) paper, which lets off the vapour that prevents corrosion of the parts inside the packing case. This should not be thrown away as long as it is effective. Absence of odor from the paper indicates loss of effectiveness. Silica Gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box. The case should be restored to its original state as far as possible.

1.3 STORAGE

The equipment should be accommodated in permanent place of storage immediately after arrival at destination.

1.3.1 The cases should be arranged in neat stacks away from walls and at least 100 mm above floor level, preferably on rail sections, and also as far as possible in the sequence of requirement of the parts for erection. Adequate gangways are to be left for inspection and cleaning. It is also recommended to repaint weight, upright position indication etc. on the side exposed for inspection.

1.3.2 To prevent distortion, the heavy parts such as stator sector, shaft and other large assemblies should be kept on raised and level ground. The articles weighing 10000 kg. and above should be arranged in a single tier. Small and medium size components are recommended to be stored on shelves.

1.3.3 For storage of stator bars/coils and insulating materials refer **APPENDIX 'C'**.

1.4 HYDRO GENERATOR COMPONENTS

In addition to general precautions there are further specific precautions for the hydro generator components which are dealt below:

1.5 STATOR FRAME SECTIONS

1.5.1 To overcome the transportation restrictions, the stator frame is sent in suitable number of parts with core & winding. If the stator is to be stored for a long time, the polythene cover has to be fully restored, silica gel or anhydrous calcium chloride (reactivate, if necessary) has to be put in the casing as desiccants.

1.5.2 Care should be taken to see that RTD wires which are kept coiled, do not entangle themselves or with other thing while the stator parts are lifted from the casing.

1.5.3 Care should be taken to see that slings is not taken over the core & winding. Refer appropriate drawing for lifting the wound stator segments.

1.6 WOUND POLE ASSEMBLY, SLIP RINGS INSULATION MATERIALS, ETC.

1.6.1 While opening the packing cases containing these, care should be taken not to poke any tool deep in the box. Field coils and slip rings are sent with fully cured insulation.

1.6.2 When the cases are to be boxed for further storage after inspection, care should be taken to cover these items with polythene sheets fully, leaving no gaps. The desiccants such as Silica Gel, Calcium Chloride have to be reactivated, if necessary.

1.6.3 The field coils are assembled round the pole with adequate insulation. In no case should the field coils be lifted off the poles. Care should be taken to see that the field coil ends are not damaged while lifting the pole assembly from the case.

1.6.4 Short life insulating materials like tapes, resins, paints, varnishes, etc. sent loose before curing have a definite short shelf life. BHEL endeavors not to send these materials such as epoxy resin, resin treated tapes etc. too early to site. Still there might be some occasions when these materials reach site early. These materials are usually sent in sealed tins with a label indicating shelf life. If these materials cannot be used immediately, these are to be stored in refrigerated storage at a temperature not exceeding 5^0 C.

1.7 RIM PUNCHING

1.7.1 The packing of rim punching is different from normal packaging because of certain design peculiarities. BHEL has adopted a friction held floating rim construction, which relies on high friction being maintained in adjacent layers of rim punching. Rim material is, therefore, bought and processed in natural finish without any protective coating on the surface, which tends to reduce the friction coefficient. During transportation and storage, these punching may be exposed to moist weather and some slight rusting is inevitable in spite of all precautions. This slight rusting is harmless if appearing in isolated spots. These get cleaned during erection. Oil must not be applied on rim punching for any purpose. If for any reason the rim punching has greasiness, these should be cleaned by volatile degreasing agents like trichloroethylene before use.

1.7.2 The protection against rusting of rim punching is hinged on the use of V.C.I (Volatile Corrosion inhibitor) paper, which lets off vapour that prevents corrosion. The Paper has a usual life of 2 years. But if wrapped in a polythene sheet the effectiveness of the vapour could be retained longer.

1.7.3 The rim punching is sent bolted rigidly to the case. Hence it is well protected. Random inspection of one more two cases is recommended and all the cases need to be opened unless any external damage of casing noticed. Measuring stack height of punching from one or two cases could do the accounting. Sufficient quantity of extra punching is sent to the complete job.

1.7.4 VCI paper is put inside polythene lining. Scrabs of paper are pushed inside the holes. These papers should be replaced by repacking.

1.7.5 The agency involved in this storage, handling and erection is advised to buy enough roles of VCI papers, for replacing spoiled or ineffective paper due to expiry of self life. The paper which has lost its effectiveness can be found out by the absence of the characteristic odor of the vapour given out by the paper.

1.8 SHAFTS AND THRUST BLOCK

1.8.1 Thrust block & guide bearing surfaces of main and top shafts are well protected against weather. The thrust block surface is mirror finished. During handling, it is imperative that this surface must be guarded scrupulously against abrasion. The protective coat should not be removed until just before assembly. Sand paper, abrasives or metallic scrapper should never be used to clean these finished surfaces. BHEL should be informed for other necessary cleaning.

1.9 THRUST AND GUIDE PADS

1.9.1 Thrust and guide pads supplied by BHEL has a layer of Tin based babbit metal chemically bonded to steel backing plate. The pads are polished to high surface finish.

1.9.2 The Babbitt metal is quite soft and can be easily scored by ferrous material. These pads should be stored in such a way as to prevent abrasion, scoring etc. These pads must not be stacked one over another.

1.10 FABRICATED COMPONENTS

Spider, bottom bracket, top bracket and their arms are included in this category. All these items are generally fabricated from mild steel, shot blasted and painted. The machined surfaces, however, are treated with corrosion protective chemicals. As these chemicals are to be removed before assembly, they are necessarily of temporary nature and can be

easily removed. Sometimes, in addition to this, aluminum foils or plywood is used to protect against mechanical damage.

As soon as the components are received at site, they should be examined for rupture of temporary rust preventive (TRP) film given at works. It is recommended that either a touch up work is done or complete new film of TRP is applied before storing. For detailed instructions, refer Appendix 'B'.

It is recommended that films be replaced twice a year, preferably before and after prolonged rainy periods. Oil and grease do not protect surface adequately. BHEL does not recommend their use as rust preventives.

1.11 PIPE WORK

Before the pipes and pipe works are sent to site, the pipes are pickled and coated with rust preventive coatings. Small-bore pipes are plugged and large bore pipes are covered with flanges. If before use the pipes have rusted due to any reason, then they have to be pickled by, one percent dilute hydrochloric acid (by volume).

1.12 INSTRUMENTS

1.12.1 Packing cases containing instruments, relays, motors etc. are marked 'fragile'. Jerks and impacts should be avoided in handling these. These cases should be fully opened and inspected for any damage on arrival. The repair and replacement of instruments takes a long time. It is recommended that all the instruments be checked for calibration. The instruments should be repacked giving adequate cushioning. The instruments could also be stored individually without the packing cases, but on properly cushioned bases, and with adequate protection against falling objects, accidental impacts etc. All instruments should be stored in a vibration free area.

For the convenience of site staff, a list of major parts and assemblies of hydro generator with the recommended storage conditions for them is given in **Appendix 'A'.**

1.13 ASSISTANCE FROM BHEL

If any problem arises in handling and storage of all components supplied by BHEL, and not already covered in these instructions, BHEL would be pleased to advise and offer suitable assistance.

APPENDIX - 'A'

RECOMMENDED TYPE OF STORAGE

Storage Type	Description of Assembly
Air conditioned storage, Temp. not to exceed 5^0 C	Insulating tapes and varnishes having short shelf life.
As per APPENDIX 'C'	Stator coils
Dry fully covered and enclosed area. Temperature inside to be 10^0 C to 15^0 C above ambient by proper heating arrangement.	Transport Stator segments, brush gear assembly, wound pole assemblies, rotor lead assembly, stator bus bar / rotor connectors, terminal connectors. All Instruments such as scanners, indicators, thermometers, flow relays etc. Stator / Rim Punching, Thrust Bearing Springs, H.S. Oil Pump Motor Sets, Brake Control Panels, Anti Condensation Heater units, Motor Starter Panels, Flexible Hose assemblies, Fire Extinguishing Equipment, Bearing Pads, Gaskets, 'O' Seals etc.
Covered area with top roof and side walls to give weather protection and stored above ground level to prevent entry of rainwater into the packages.	Air coolers, oil coolers, brake assy. / lining, shaft and oil sleeve assembly, hardware for building the rim, rim end plates, rim / core studs, stator key bars, pressing plates, rim & pole keys, fan assemblies, supports, shims, spider hub and brake track, stator segments, thrust / guide bearing housing, spider arms, valves, elbows, unions, couplers, foundation bolts-studs washers, baffle tray assembly, cooling water / oil pipes, hardware Flooring, Air Guides, etc.

APPENDIX - 'B'

PROTECTION OF FERROUS COMPONENTS

WITH TEMPORARY RUST PREVENTIVE SYSTEM

1.0 INTRODUCTION:

All components dispatched from BHEL-Bhopal would have been given protection against rust by application of one of the following paints. However, if any site application is necessary due to long storage, following guidelines should be kept in mind. **NOTE: Normally after an interval of six months, the surface of TRP coated jobs shall be examined for any damage, corrosion spots etc. If required, repair should be done and TRP reapplied.**

1.1 MATERIALS

For use BHEL recommends the following Temporary Rust Preventives (TRP):

1.1.1 NON-DRYING TYPE (PIGMENTED) BP 55191

This can be applied with brush resulting in soft non-drying film. This provides protection for a period not exceeding 4 to 6 months. This can be removed with white spirit. Because of non drying nature of the film, it runs the risk of getting wiped off accidentally and exposing that area to corrosion. Hence, more care is required during storage.

1.1.2 DRYING TYPE (PIGMENTED) AA 55155

This can be applied with brush resulting in thin dry film which can be removed with white spirit, Xylol or Toluol. It provides protection for a period upto six months.

1.1.3 DRYING TYPE (BLACK) AA 55154

This can be applied with brush resulting in a thin dry film which can be removed with white spirit. This would provide protection for period of 12 months. It is good for out door applications.

1.1.4 OTHER MATERIALS THAT WOULD BE REQUIRED IN THE PROCESS

(a) Xylol

(b) Toluol

(c) Mineral Turpentine (White Spirit)

(d) Derusting Solution (Rust Removal) BP 55193

2.0 SURFACE CLEANING

Before any TRP is applied on any metal surface the surface should be free from old TRP, rust, grease etc. It may be emphasised that the effectiveness of the TRP is reduced or even nullified if the surface is left contaminated.

2.1 Remove the old TRP with the help of white spirit.

2.2 Remove the rust spots using sufficient quantity of de-rust solution rubbing with clean cloth. Clean the surface with cloth soaked in water. In case the surface is still not clean, repeat the process. Finally remove the residual acid from the surface with the help of wet cotton; otherwise it may cause further corrosion.

2.3 Dry the surface with the help of hot air blower.

2.4 Wipe off the surface with clean cloth having small quantity of uncontaminated white spirit. Allow the solvent to evaporate. The surface is now ready for TRP application.

1.0 TRP SYSTEM & ITS APPLICATION:

CATEGORY OF TRP	SEQUENCE OF COATS AND MATERIAL USED			PROCESS	APPLICATION
	I COAT	II COAT	III COAT		
CATEGORY 'A' (3-COAT SYSTEM)	**AA55155**	**AA55154**	**AA55154**	CLEAN SURFACES & SEQUENTIALY APPLY EACH COAT FOLLOWED BY AIR DRYING FOR 12 HRS.	JOURNAL FACES, HIGHLY FINISHED SURFACES SUCH AS THRUST FACE, BEARING SURFACES OF SHAFTS ETC.
CATEGORY 'B' (2-COAT SYSTEM)	**AA55155**	**AA55154**	**AA55154**	CLEAN SURFACES & SEQUENTIALY APPLY EACH COAT FOLLOWED BY AIR DRYING FOR 12 HRS.	MACHINED SURFACES OF MAJOR COMPONENTS i.e. TOP AND BOTTOM BKTS, STATOR, SPIDER, GU. BRG. SUPPORT RING, SHAFT FLANGES. ETC.
CATEGORY 'C' (2-COAT SYSTEM)	**AA55154** (ON NON-THREADED PORTION) & **BP55191** (ON THREADED PORTION)	**AA55154**	----------	CLEAN SURFACES & SEQUENTIALY APPLY EACH COAT FOLLOWED BY AIR DRYING FOR 12 HRS.	ALL FASTENERS & THREDED PORTION, EXCEPT FOR PLATED AND GALVINISED FASTENERS.
CATEGORY 'D' (2-COAT SYSTEM)	**AA55155**	**AA55154**	----------	CLEAN SURFACES & SEQUENTIALY APPLY EACH COAT FOLLOWED BY AIR DRYING FOR 12 HRS.	SMALL MACHINED COMPONENTS & OTHER COMPONENTS NOT DEFINED IN CATEGORY A,B,C.

4.0 PRECAUTIONS

4.1 TRP should be stirred well in the original container so as to make a homogeneous mixture of its constituents.

4.2 Container and brush must be cleaned after application with white spirit before keeping for next operation.

4.3 During the drying period, the wet film should be protected from deposition of dust particles by providing an umbrella of polythene sheet.

4.4 Protections given for TRP film, such as aluminum sheet, plywood etc. should be replaced after application of TRP. The surface coming in contact with the job should be given a liberal coat of AA 55154.

4.5 Normally after an interval of six months, the surfaces of TRP coated jobs shall be examined for any damage, corrosion spots, etc. and repair should be done along with application of TRP.

4.6 BHEL also generally supplies additional quantity of above materials for site use as per contract agreement. However, additional quantity of special BHEL manufactured items like BP 55191, AA 55154, AA 55155 and BP 55193 can be procured from BHEL Bhopal, if required by customer. However, Xylol, Toluol and white spirit shall be purchased from good chemical suppliers, directly from the market.

5.0 NOTE:

The TRP specifications given are for reference only. These are proprietary to BHEL and can be procured from BHEL, Bhopal as and when required by quoting the specification number.

APPENDIX - 'C'

BHOPAL	INSULATION SKETCH	IN.SK. 30271
	INSULATION SYSTEMS ENGINEERING	Rev. No.: 01
	INSTRUCTIONS FOR STORAGE OF BARS/ COILS AND INSULATION MATERIALS AT SITE	Rev. Dt.: 24/02/2005
		Sht. 1 of 1 shts.

INSULATION CLASS - F

1. **General**
   These instructions are to be followed at site for storage of bars/ coils and insulating materials. Proper handling and storage of bars/ coils and insulating materials is necessary to achieve a long trouble free service of the equipment. Bars/ coils and insulating materials need special care to avoid damages during storage. Insulation is affected by excess moisture, dust, temperatures beyond the designed value and other environmental factors like chemical fumes, corrosive atmosphere etc.

2. The bars/ coils supplied are individually wrapped with polythene tape and cotton tape. A set of bars/ coils are packed in wooden boxes lined with suitable packing material. Relative movement of bars/ coils is avoided by suitably anchoring them. The bars/ coils are supported with soft padding material like thermocol/ coir/ wool felt.

3. Inspect the package as soon as it is received at site and report damages, if any, immediately. While opening the packing cases, care shall be taken not to poke any tool deep into the box. Bars/ coils are sent with fully cured insulation and do not require a low temperature storage. However, they should be stored in a dust free, low humidity area at ambient temperature (less than 45 °C). Bars/ Coils/ Cases containing bars/ coils should never be stored in open area.

4. When the bars/ coils are to be stored for some more time after inspection, care shall be taken to cover the items with polythene sheets, along with desiccants like silica gel, leaving no gaps. Silica gel may be reactivated by heating, if necessary. A deep blue colour indicates presence of moisture and after heating, it turns pinkish white which indicates it is ready to be used again. It is recommended to store the bars/ coils in original packing as far as possible. Care shall be taken not to deform the bar/ coil shape. If bars/ coils are to be stored in stands other than original packing case, such stands should be kept in well ventilated rooms at ambient temperature and low humidity. Suitable padding material shall be used for keeping bars/ coils and in no case the bars/ coils shall be kept one over other without suitable separators. Keeping bars/ coils side by side is a standard practice. Do not remove the polythene tape and cotton tape until the bar/ coil is to be assembled. If removed on a few bars/ coils for inspection purposes, apply back the tapes to protect the bar/ coil from dust spoiling the corona paint and anti-tracking coating.

5. The insulating materials shall be stored in original packing in dust free, well ventilated, low humidity area. Short shelf life materials should be stored in low temperature stores as recommended. Additional safety precautions, if required, shall be strictly adhered to in the case of solvents and other resins.

   Note
   Before use, the bars/ coils should be thoroughly inspected for any physical damage to insulation/ copper conductors. Any bar/ coil found with damages should not be used.

6. **Changes Due to Revision**
   Insulation sketch reviewed and updated.

Distribution:		Date of Rev. 00: 29/10/1992	Name	Signature
FDS	3	Prepared by	Nidhi Gupta	Nidhi
HGE	2	Checked by	A. Tijare	
		Approved by	K.N. Das	
		Issued by	A. Tijare	

ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED

Bharat Heavy Electricals Limited
(A Govt. of India Undertaking)
Power Sector- Northern Region

Rev. 01

BHEL/PSNR/Site..... Dated: _____

MEMO for imposition of penalty against non-compliances in Quality area

The Lapse as tick marked below has been observed in your area and penalty is being imposed as per the details mentioned at the bottom of this memo:-

S. No	Nature of non- compliance	Penalty (in Rs.)	Remarks
1.	Non availability of required no. of Quality Engineers/NDT certified person as per contract	1000	Per Person
Calibration:-			
2.	Use of IMTEs without having valid calibration certificate	1000	Per equipment per instance
3.	Use of NDT equipment, welding equipment's without having valid calibration certificate, condition not as per requirement	1000	Per equipment per instance
Welding & NDT area:-			
4.	Un qualified Welder carrying out weld/ tack weld	1000	Per welder per instance
5.	Not using portable oven	500	Per welder per instance
6.	Not using electrodes pre- baked in master oven/ approved make of electrodes/correct electrodes as per EWS/ WPS	500	Per instance
7.	Non- removal of slag and spatters after welding	200	Per Joint
8.	Not using NDT equipment as prescribed in the manual/contract/guidelines	1000	Per equipment per instance
9.	Welder doing welding without job card	500	Per instance
10.	Discrepancy observed in the RT taken of weld joints vs RT offered	2000	Per joint
Material management:-			
11.	Mismatch of location of material in store area wrt in Stock register	200	Per instance
12.	Non- compliance of preservation of material as per storage & preservation manual	1000	Per equipment
13.	Non verification of material within stipulated time as per contract	500	Per instance
Other Areas:-			
14.	Painting without surface cleaning	500	Per instance
15.	Not attending Quality meeting by the nominated member	1000	Per meeting

Details of non- compliance (Name of Sub contractors, persons, description of deficiency, etc.)

_____

_____

Penalty imposed:-

1, Rate as per above chart_____

2. No. of Persons/ equipment/ instance/ Joint/ welder/meeting. _____

3. Total Penalty= 1. X 2. =_____

Signature

(Witnessed by Sub- Contractor representative)
Name_____

(Witnessed by PSNR Personnel)
Name_____

Distribution: 1. Sub- contractor
2. Head (Quality & Safety)/ BHEL PSNR